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THE AUTOMOBILE

Coming of the Silent Motor

What the Market Affords Besides the Poppet Valve

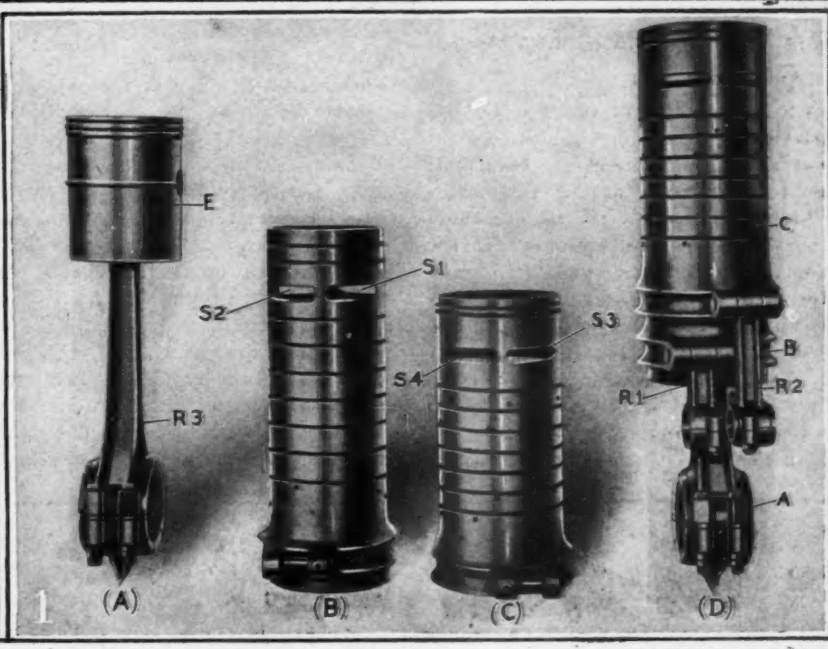


Fig. 1—Presenting the connecting rod assembly of the sleeve type of motor, also the connecting rod with its piston in place, as well as the sleeves after they were taken out of a motor following 6,000 miles of tryout work

Thomas J. Fay, Editor of THE AUTOMOBILE, *presents the first of a series of articles dealing with the problems of motors, with particular reference to other than poppet valve types, taking up the several questions as they are influenced by the conditions of the service in America, relating the causes for the differences in the practices between American and foreign countries, taking advantage of the actual products as they are being made in America to illustrate the points to be emphasized.*

AUTOMOBILISTS in this country have listened to the murmurings of the builders of automobiles in England and on the Continent, and the trend in these quarters has undoubtedly been in the direction of the sleeve type of motor and the silent chain. Coupled with these stars of the automobile world the long stroke design of motor has been a conspicuous factor, but few indeed are the students of automobile designing in this country who were able to account for the lethargy of American designers, if such it was. At all events, the production in this country has been held tenaciously to previously fixed standards, and a careful study of the situation would seem to indicate that the acumen of the American maker has not been dulled by practice in the face of a divergency of experience.

That a fact may be quite apparent to even a man of skill, and yet be difficult to define, is shown by the very delay that is present in the motor situation; and those who have given themselves to the task of understanding these things long ago arrived at the conclusion that a good automobile on a Roman road in France or in England is the veriest junk pile on a dirt road in America. We cannot run cars in this country when the clearance is four inches, nor can we accept the practice of the builder of the type of car that has a four-inch clearance, hampering the same by the mere expedient of changing the camber of the springs to get the extra clearance when it is desired to ship and use this foreign clearance car in places where the roads are substantially unimproved.

If an automobile is to perform with good satisfaction on unimproved roads it must be designed with special reference to the road condition, and the clearance that must obtain requires a considerable effort on the part of the designer, since he must depart absolutely from foreign practice, and, while holding the

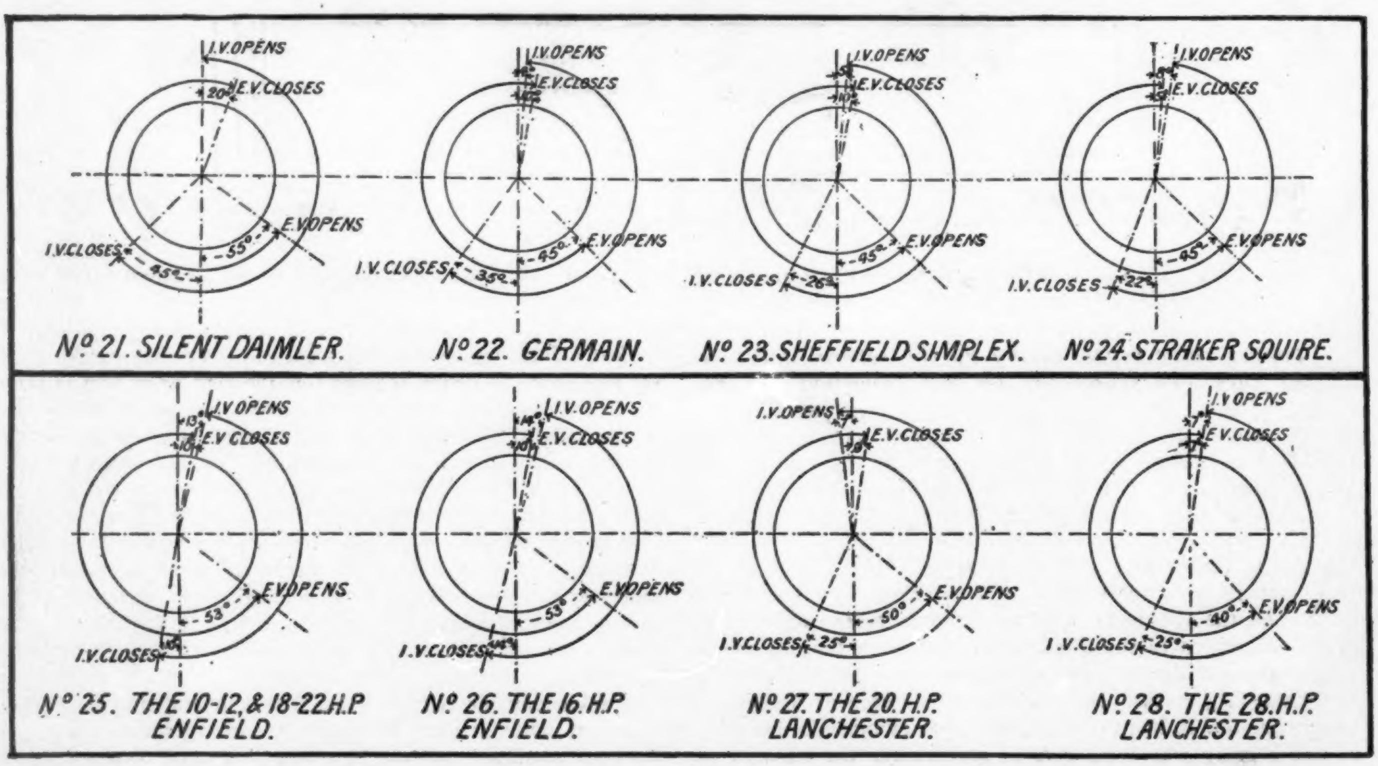
center of gravity as low as possible, keep the mass from scattering, and poise the same so that it will not partake of a cranky set of movements in response to speed and road inequalities. It would have been a simple matter for American designers to accept the practice as it comes from overseas and enjoy the good performance of the sleeve types of motors, were there nothing in the rest of the designing problem; but wisdom and experience have had the effect of applying the brake to activities of this character for a sufficient time to permit the designers to revise the chassis characteristics to accord with the new requirement.

It will be impossible to predict the extent to which sleeve and rotary types of valves will be used in automobile motors in the near course of events, but there is ample evidence of the fact that this movement is wide and appearances are in favor of the contention that it has taken on a permanent phase. At all events, the time has arrived when it will be opportune to present the whole subject in a series of articles, rather than to try to cover the matter in a single article at some length, but it is not believed that there should be much more theorizing, nor is it necessary to thus lamely proceed, since examples of the work that is being done may be used to illustrate the points to be made, and for this particular effect the new Stearns-Knight and Columbia-Knight motors will be described and discussed.

Discussion Is Toning Down in the Light of Experiences Gained

Some years ago when Charles Y. Knight brought out his sleeve type of motor in America he was evidently ahead of the state of the art, and he was unable to arouse any considerable measure of interest in this type of motor at that time. Circumstances culminated in the bringing out of the Silent Knight motor in England, and the success of this motor under the direction of the British-Daimler Company was sufficiently marked to attract the attention of such companies as the Panhard in France, Minerva in Belgium, Mercedes in Germany, and the company of the same name in Austria. The earlier negotiations on the part of Mr. Knight with the makers of automobiles in America made it somewhat uncertain as to which of the companies would adopt this motor, and we understand that the Knight contract with the above named foreign makers of automobiles is such that his right to license American companies is limited to four concerns. We are unable at this time to enter into a description of the Knight type of motor as it will be used in more than two of these companies, and the descriptive matter hereinafter is confined to the Stearns-Knight motor and the Columbia-Knight motor, and we regret to state that the information given in relation to the Columbia-Knight motor is somewhat less complete than is our wont, due to the fact that the Columbia-Knight car is going through long and continued road tests, so that it has been impossible to get photographs of such of the details as would seem to lend interest to this discussion, so that right is reserved to go into the matter of details at some length at a propitious time.

There will undoubtedly be a great deal of discussion in relation to the sleeve type of motor versus poppet valve types of motors, and users of automobiles may have some difficulty in arriving at a proper conclusion of the position that they ought to take relative to these types of motors. But users of automobiles can well afford to take into account a plurality of considerations; for instance, in the preparation of material that will be used in the further discussion of motors in articles that we propose to run, discovery has been made of 54 designs of motors, other than poppet valve types, that have been worked upon and are being tried out with more or less satisfaction. It is not the purpose here to either suggest or advocate that comparisons be made in the absence of authenticated data, and we are struck by the fairness of the attitude of Charles Y. Knight in his discussion at various times relating to the merit of the sleeve type of motor as it compares with motors of other generic types. Quoting from Mr. Knight's paper entitled "The Valveless Engine" in a paper read before the Royal Automobile Club as far back as October 15, 1908, Mr. Knight said: "It was not valve trouble which inspired me with the desire to build a motor different from the then accepted type." From this statement it will be seen that the inventor had no grievance against poppet valve types of motors of the character that is brought to bear in promiscuous discussion, and we will have to look further in Mr. Knight's presentation of his matter to find out what he did think. In this connection the inventor went on to say, "I struck out boldly along new lines



Selection from a series of timing diagrams that appeared in the Motor Car Journal, showing the settings of the intake and exhaust valves of several different makes of motors, including a Knight motor

for the very good reason that close association of over 20 years with mechanical matters taught me that a novice in any special field had little chance of improving upon an accepted design. I clearly made up my mind, if possible, to produce an internal combustion motor different from anything which had yet been constructed." It will be seen from this statement that Mr. Knight's initial interest in the matter had the same impetus as that which induced hundreds of inventors in many lands to build automobile motors, and, like his confreres in the same zone of activities, he had to take his chances with the rest and follow the bent of an inventor's inspiration, buoyed up by the enthusiasm of which genius always has a surfeit.

In putting the matter up to the British-Daimler Company, Mr. Knight relates the attending circumstances in language as follows: "We did not bring to the Daimler Company an untried proposition. We brought a practical although not refined product—a motor which had already withstood the test of public use for two years, and came through with clear records, numerous drastic tests in public competitions with the best motors of the other types." In pronouncing on the question of power, Mr. Knight states: "The only feature regarding which we made no representations to the Daimler management was the matter of power as compared with the other types, as conditions under which tests are made in different establishments vary to such a degree that even now I place little credence upon what I read regarding the performance of any motor under tests in its own works."

Early History of the Knight Motor Building Effort

In recounting his adventures Mr. Knight stated in his paper of October 15, 1908: "Experimental work began upon this motor five years ago last August. The first model was 3 1-2 by 4 inches, single cylinder horizontal. It was operated successfully through the use of but one sleeve, but the gear necessary to give it the proper motion was too complicated to be quiet, and this construction later gave way to two sleeves driven from an eccentric shaft. We experimented one whole Winter in the shop before any effort was made to design a practical motor for car use, and when this motor was finally undertaken during the winter of 1904, the result was a four-cylinder engine, 3 1-2 inches bore by 4 inches stroke. This motor was finished in October of 1904 and put into a Panhard type car which I had driven for two years. This motor is running to-day in the self-same car. I drove it about 4,000 miles that winter and about 8,000 miles the next season.

"We designed and constructed our first experimental car in the Spring of 1905, this being equipped with a four-cylinder 4-inch by 4 3-4-inch motor, with practically no change in design. This car is in service to-day."

A side light upon the activities of the inventor in this case will suffice to indicate something of the vicissitudes that beset the path of the soldier of fortune and the man who wants to bring out something new, and Mr. Knight's own language will best bring out the point that is here to be made: "I have no doubt that had I come into contact at that time with some of the critical experts whom it has been my good fortune since to meet I should have been dissuaded from spending a dollar upon the idea, yet, in the light of recent startling mechanical and scientific developments, I have almost reached a state of mind when I hesitate to entertain or express doubts regarding the possibilities of any reported accomplishment. * * * Frank Munsey, one of the world's most successful publishers, in a treatise on the subject of 'Schemes' for increasing the volume of business, said: 'If you have an idea and have confidence in yourself go ahead and work it out. It's all well and good to look around and see just what is the condition of the channel ahead of you, but if you have any hope of being successful don't by any means call in a dozen advisers and discuss your scheme with them. The best idea that was ever born can be talked to death around a council table. If you expect to devise anything that does not involve some risk you are smarter than the average smart man. If you have an idea and have confidence in yourself it is up to you to grasp the situation vigorously and surmount the obstacles. Counsellors will undoubtedly point out stumbling blocks. It is for you to get over these. Any man can do an easy thing. Ability means the power to do things other people think cannot be done or fear to undertake.'" In thus taking serious notice of the rather good advice from the trenchant pen of Frank Munsey and emulating the idea in practice under what must have been a difficult set of conditions, Mr. Knight has been good enough to indicate one of the reasons why he reached the goal of success, and this may be the precise ground that other inventors take in the struggle that is now going on, nor can we tell at this time how many individual efforts are being given the force of persistent attention, excepting that we have been able to find 54 examples outside of the poppet-valve field.

Stearns-Knight Motor Introduced

Chassis Revised to Assume New Responsibility

A discussion of the new Stearns-Knight motor, presenting reproductions of working drawings of the chassis, and halftone reproductions from photographs of the motor after it was operated in a car for about 6,000 miles and taken apart under the direction of the author for the purpose of observing the conditions for lubrication, showing the condition of bearing surfaces of the sleeves and other functioning parts of the motor. From the power point of view a Prony brake test is given of the new Stearns-Knight motor, and a second Prony brake test is offered showing the power and characteristic of the Stearns poppet valve type of motor, the idea being to bring out the difference in the service characteristics of the two types of motors and to show wherein the Stearns-Knight motor differs from the earlier effort.

REMEMBERING that there will be ample opportunity on the part of the patrons of the automobile industry to gather such information as may be had in the course of mere discussion bearing upon the features of sleeve types of motors, it seemed to be in keeping with the situation to examine into the performance of the new Stearns-Knight motor as it is made in the plant of the F. B. Stearns Company, Cleveland, Ohio, and to compare the details of actual road performance with the motor characteristic, observing in the meantime the extent of agreement. In the road tests it was found that the motor throttled down under hill-climbing conditions and accelerated on a grade satisfactorily even with a fixed spark advance, and that the motor presents a wide range of stability despite an indifferent attempt at timing the spark. It will be remembered that the timing of the Knight motor is a matter that the designer is permitted to fix upon much in the same way that poppet valve types of motors are timed, and the dia-

gram given below shows the preferred timing as fixed upon by Charles Y. Knight in his effort on behalf of the British-Daimler Company compared with accepted timings of good makes of poppet valve types of motors, and it will be seen that the Knight timing is as follows: The inlet port is timed to open on the top dead center and to close 45 degrees up on the compression stroke. The exhaust port opens (early) 55 degrees before the end of the firing stroke, and closes (late) 20 degrees down on the suction stroke.

Referring to the curves of motor performances as shown in Fig. M of the Stearns-Knight motor as compared with Fig. N of the Stearns poppet valve type of motor, it will be at once apparent that the torque characteristic of the Knight type of motor is at wide variance with the torque characteristic of the Stearns poppet valve type of motor. A mere examination of the torque curve of the Stearns-Knight motor would suffice to show that it is an easy motor to crank, and actual experience with the motor bears out this surmise. In the face of "soft" cranking, which would indicate poor compression in a poppet valve type of motor, the actual torque at low speed is relatively high, and it is an advantageous fact that this torque increases with increasing speed for a large part of the range, and recedes but slowly thereafter up to 2300 revolutions per minute.

What Investigation Shows in Relation to the Performance of American-made Sleeve Types of Motors

Referring to the illustration (Fig. 1) of the Stearns-Knight motor construction, (A) shows the piston and connecting rod, (B) is of the inner sleeve, (C) presents the outer sleeve and (D) is an assembly of the connecting rod A with the inner sleeve B and the outer sleeve C in the concentric relation with the piston E just as they go in a cylinder of the motor. These sleeves are reciprocated by means of connecting rods R1 for the inner sleeve and R2 for the outer sleeve, and they are actuated by an eccentric shaft S1 in Fig. 7, whereas the piston attached to its connecting rod R3 is actuated by the crankshaft C1 in Fig. 7. The group as shown in Fig. 1 supplemented by the crankshaft and eccentric shaft as presented in Fig. 7, constitute the functioning mechanisms in the Stearns-Knight type of motor in substitution of poppet valve mechanisms of former practice. Instead of actuating poppet valves for the purpose of controlling the mixture and the exhaust, the sleeves B and C in the concentric relation with the reciprocating piston move on each other so that the slots S1 and S2 in the sleeve B register with the slots S3 and S4 in the sleeve C in registry with transfer ports in the cylinder proper, according to the most approved four-cycle timing of a motor, thus doing the work as it is required in the performance of the motor according to the Otto cycle.

By referring to Fig. 6 it will be seen how the sleeves (B) and (C) fit in the bores of the cylinder (A), and the transfer ports P1 and P2 as they show in this pair of cylinders are so placed as to register with the slots S1 and S2 of the concentrically related sleeves (B) and (C) when they are nested in the cylinder, of which there are four in this motor, for the intended purpose.

The Piston Is Flattened on Two Diameters in the Plane of Minimum Pressure for the Purpose of Working the Motor with Low Clearance.

Fig. 2 shows a pair of the cylinders as they were photographed in place on the motor as it was taken down by the writer after the automobile in which it was mounted had traveled approximately 6,000 miles, and in view of the fact that the photographs were taken by a most excellent camera under particularly favorable conditions, the reader is enabled to judge of the conditions of lubrication that must have obtained during the entire performance of the motor, as indicated by the highly polished surfaces at every point, with entire absence of scoring or other blemishes such as would be present were the lubrication faulty and the motor made to serve for so long a time in a "try-out." Referring to Fig. 2 in the cylinder S1, the surfaces that come into view are of the cylinder wall proper, whereas the surface S2 is that of the offset of the cylinder, and the surface S3 is the inner surface of the short sleeve as shown in (C) in Fig. 1, bringing the edge of the long sleeve S4 into view. The holding bolts B1, B2, B3, B4, B5, and B6, for each cylinder, are used to hold the cylinder heads as they are shown in Fig. 5 in place; and referring to this latter figure the junk rings R1, R2, R3 and R4 are clearly indicated above auxiliary rings R5, R6, R7 and R8. The junk rings and the auxiliary rings above them bear against the inner surfaces of the long sleeves maintaining tightness between the junk ring assembled in the head of the motor and the bore in which the piston reciprocates, thus preventing compression from leaking around the tops of the rings or through the openings in the sleeve, it being the case that the junk ring is so wide that it covers the sleeve ports, including a considerable overlap for the obvious purpose. The illustrations of the four cylinder heads H1, H2, H3 and H4 in Fig. 5 having been reproduced from photographs of the actual cylinder heads as they were taken out of the motor by the author, show the effect of the long service test to which the motor was subjected, and the junk rings clearly indicate that the surfaces all over were highly polished and that the conditions of lubrication were particularly good. The cylinder heads have cavities C1, C2, C3 and C4 forming the combustion chamber proper, and the spark plugs S1 shown in the head H3 protrude through the depressed heads into the hottest part of the combustion chamber, where they are in the flush position, and the thermic conditions obtaining are somewhat indicated from the fact that the growth of a carbon deposit is only barely indicated at G1 in the head H1, at G2 in the head H2, and G3 in the head H4, it being the case that the head H3 is tilted so that the cavity does not come into view, but the author is able to state that the coat of carbon residing therein was in no greater presence than that shown in the examples that are here to be seen.

The two cylinders as presented in Fig. 2 were the third and fourth of the motor lying next to the dashboard in the car. The two front cylinders were removed and were photographed, as shown in Fig. 6, alongside of one of the pairs of sleeves. Referring to Fig. 10, the front end of the motor with the front pair of cylinders removed is brought into view, and the sleeves of cylinder No. 1 were then removed, allowing the piston P1 to be seen, showing the piston rings R1, R2 and R3 above the piston pin, and the piston ring R4 in the plane of the piston pin, all of them in a highly polished state, showing every evidence of good lubrication and a tight performance. The piston head H1 shows a slight growth of carbon G1 in the bowl, and attention is called to the fact that the piston head is depressed, forming a segment of a sphere, the idea being to properly regulate the compression ratio, remembering that the head is inverted and fills some of the space in the bore; but there is a further object in depressing the piston head, the portent of which is enough to dictate this shaping, it being the case that a layer of gas fills the depression so formed and shields the metal of the piston head from the hot glare of the burning gas, thus eliminating a very serious thermic trouble in motor work.

The second cylinder as shown in Fig. 10 was photographed with the sleeves S1 and S2 in place, and attention is called to the bright surfaces S3 and S4 around the port P2, thus indicating that a tight relation obtains, and it may be proper to say here that the presence of carbon at the lips of the ports has proven to be a boon rather than a detriment, due to the fact that the carbon and the lubricating oil are mixed and ground into an infinitely fine state, and the latter fills in the interstices, if such there are, leveling off the surfaces, perpetuating the condition of good performance, and this is probably one of the reasons why the Knight type of motor performs so very much better after a considerable period of service than it does when it is brand-new. In the investigation of the carbon deposit question for the purpose of finding out whether or not the sleeve type of motor would be clogged up by carbon deposits, a series of little grooves cut with a diamond-pointed tool were made on each side of one

of the ports of a sleeve, and the examination of this roughened zone in the proximity of the lips of the ports after a considerable service showed that the grooves had completely filled up with a prime carbon paste, and that the leakage which might have been induced originally by the roughening of the surfaces in this critical zone had departed entirely, and the motor performed quite as satisfactorily as if the sleeves had been left in their original polished condition. From this and other evidence it would seem that the original claims for the Knight type of motor, which had for their foundation the idea that the motor improved with service, are based upon the beneficial action that takes place when fine carbon dust is mixed with lubricating oil and rubbed into the surfaces of the metal. There is a great difference between forming a scale out of carbon, silicon and other substances and allowing it to deposit over the heated surfaces of the combustion chamber and the manufacture of a carbon paste, rubbing it into the pores of the metal as fast as it is formed, which is the action that takes place in the sleeve type of motor. In a word, the formation of carbon is beneficial to the motor, in that it manufactures graphite, which is known to be an efficacious lubricant, and as fast as this lubricant is manufactured it is taken up between the rubbing surfaces of the sleeves, and while it is being ground into an intimate mixture it is being rubbed into the pores of the metal, filling the interstices at every point and producing surfaces that are mirror-like in every particular.

Having Examined the Surfaces of the Sleeves from Photographs Taken from a Motor That Had Done Long Service It Remains to Study the Working Drawings and Observe of the Things That Were Done to Harmonize this Type of Motor in a Chassis That Has Proven Its Worth Under American Road Conditions

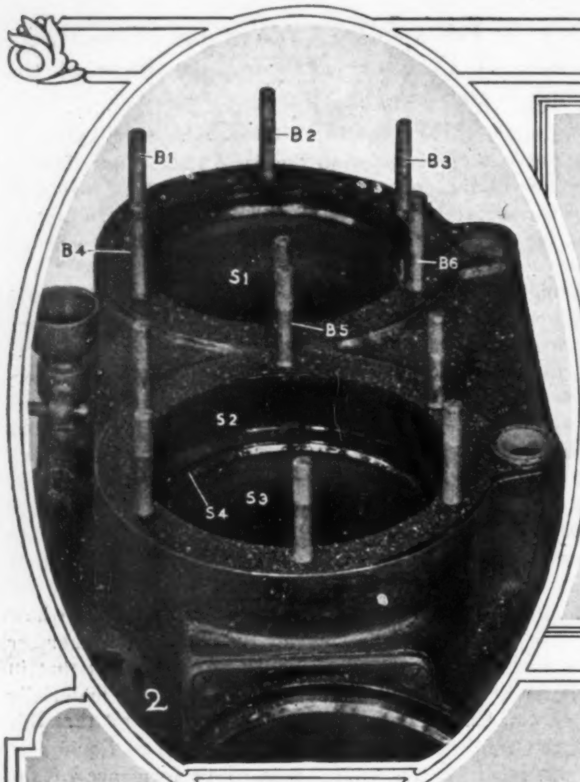
Referring to illustration C, which is a section of the motor through a cylinder, it will be seen how the long sleeve S1 serves as the bore for the piston P1, and how the short sleeve S2 is sandwiched between the long sleeve S1 and the cylinder wall W1. It will also be seen how the cylinder head H1 is flanged over at F1, fitting the cylinder proper, making room for the sleeves S1 and S2 between the bore of the cylinder in the head and the inserted part of the cylinder head H1, allowing also the space for the junk ring J1, which serves to cover the ports P2 in the outer sleeve and P3 in the inner sleeve, and with the sleeves in the position as shown the exhaust ports P4 in the outer sleeve and P5 in the inner sleeve are also covered by the overlapping of the sleeves under the conditions as observed, so that the combustion chamber is tight against compression, and any leakage possible to consider must pass by the junk ring J1, bleed across the lip surfaces and then negotiate the bearing faces between the sleeves. A study of the section of the motor in the vicinity of the ports will suffice to show that tightness against the leakage of compression is a condition that improves with service, due to the fact that the surfaces are slowly but surely undergoing a process of polishing. Moreover, the lubricating oil as it is sucked up between the sleeves has such a large surface to cling to, remembering that it has a high surface tension, produces a self-packing condition that is not to be overcome by any pressure that can be brought to bear, and the action that takes place under working conditions brings about the shearing of the lubricant in its section, so that the actual work done is within the molecular structure of the lubricating oil. It is impossible to consider that there is any metal-to-metal contact of the sleeves and the cylinder walls, and the polishing effect that is indicated by continued service is at such a slow rate that over 5,000 miles of travel of an automobile on the road under the impetus of this motor is barely sufficient to remove the evidences of grinding of the sleeves, in the face of the fact that the grinding work was done with scrupulous care.

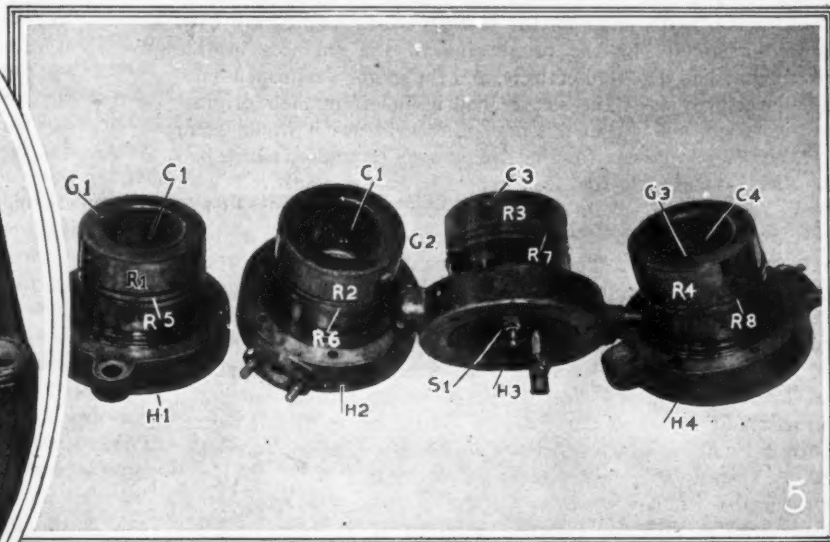
Great Care Is Taken to Cool All of the Flame-Swept Surfaces by Carefully Directing the Flow of the Cooling Water

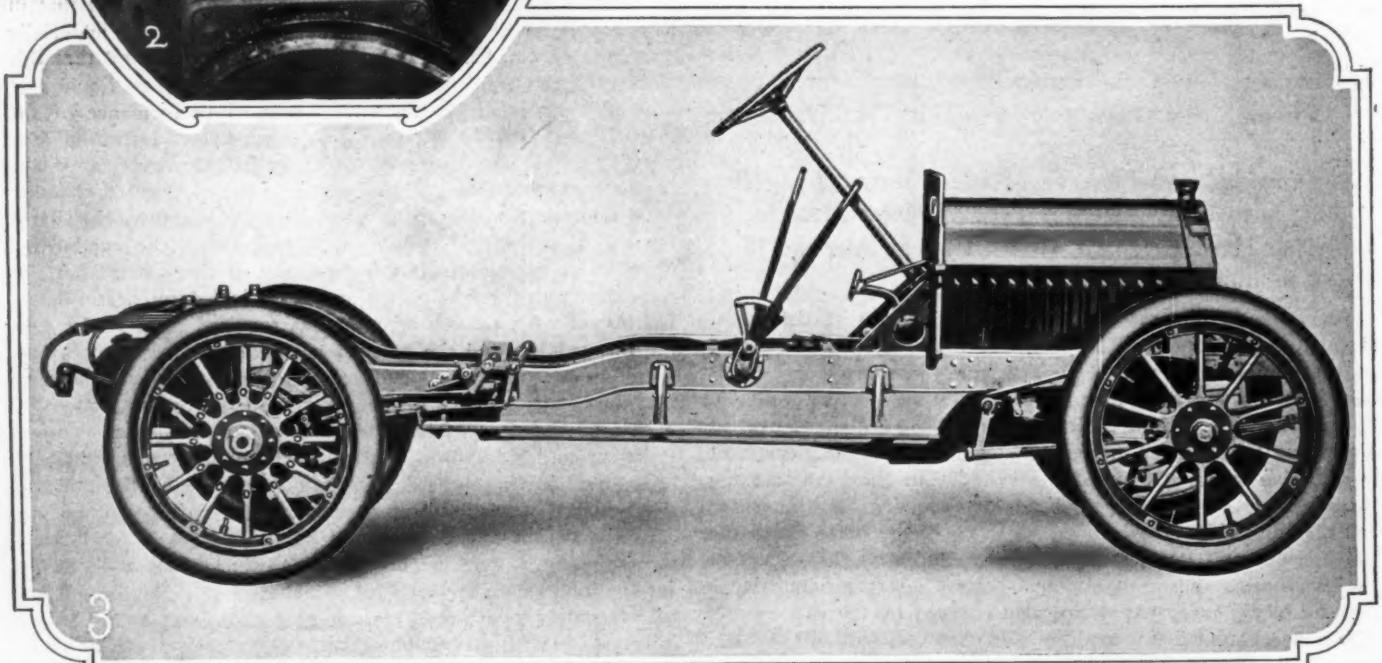
Referring again to Fig. C, it will be seen how the cylinders and heads are water-jacketed, and the baffle plates (not shown) direct the flow of the cooling water in a spiral sheet, sweeping over all of the surfaces, allowing the same to leave at the highest point, entering the water outlet at the top, traversing the length of the water manifold to the receiving point in the radiator. The extremely high mean effective pressure that is shown in this motor is partly accounted for by the liberal area of the inlet and exhaust ports, but a study of the motor performance goes to show that this accounting is insufficient, since the motor characteristic is markedly different from that which obtains in motors that have poppet valves of large areas with a timing the same as that which is employed in this particular motor. It has been suggested that the high mean pressure realized is in a large measure due to cold lips of the parts brought about by the precision with which a liberal supply of cooling water is permitted to brush the surfaces in juxtaposition to the lips of the ports, thus maintaining a constant low temperature. In the shaping of the inlet passageway, as it approaches the ports, it will be seen how the grade is sloping in the direction of the combustion chamber with entire freedom from "baffles," and it is pointed out that in this detail the Stearns-Knight type of motor differs materially from the earlier Knight designs, it having been found that this sloping of the gradient prevents the accumulation of liquid fuel and adds materially to the smoothness of performance of the motor, but it is to be regretted that this section illustration does not show that the hydraulic grade is in the direction of the carbureter rather than in the direction of the combustion chamber of the motor for the major portion of the distance, the divide coming in the transfer port as it approaches the combustion chamber of the motor. An examination of the exhaust port, as compared with the inlet port, shows a distinct difference in detail, for instead of a smooth approach, as required on the inlet side, the lip curls up and the exhaust gas after it passes out is permitted to expand, and it would seem from what has been observed that the compact screen of gas remains in its compact state until it gets by the port, after which it swells, maintaining a certain intimacy, and it departs by way of the exhaust manifold as a body, thus leaving behind a certain excellence of the state of scavenging that has not been experienced heretofore.

In the design and construction of the sleeves S1 and S2 as shown in Fig. C care has been taken to thicken the walls at W2 for the long sleeve and W3 for the short sleeve for the purpose of adequately resisting the work that they have to do in the interpretation of the reciprocating motion as it is delivered to the sleeve by the connecting rods R1 for the long sleeve and R2 for the short sleeve, as delivered through the good office of the eccentric shaft E1. The bosses to which the connecting rod pins relate are joined to the sleeve through the section of metal formed with a pair of parallel ribs running around the girth at the extremities of the sleeves. The fact that the sleeves are given their reciprocating motion by means of connecting rods. actuated by an eccentric, imparting the motion to one diameter of the sleeves, has been commented upon as indicating diagonal loading and a tendency to induce a lateral thrust, corresponding to a diagonal characteristic, but it is feared that those who gave this matter the benefit of their distinguished consideration were too busy to construct a diagonal of the forces, and they therefore failed to penetrate sufficiently into the intricacies of the problem to permit them to arrive at the conclusion that the lateral pressure is merely nominal, due to the fact that the sleeves are of great length as compared with diameter, so that the diagonal of the forces, when expressed in pounds per square inch on the projected area of the sleeves, is resolved into a mere decimal of a unit.

The water pump W4 is of the centrifugal paddle type, and the intake I1 passes in the horizontal plane from the under side of







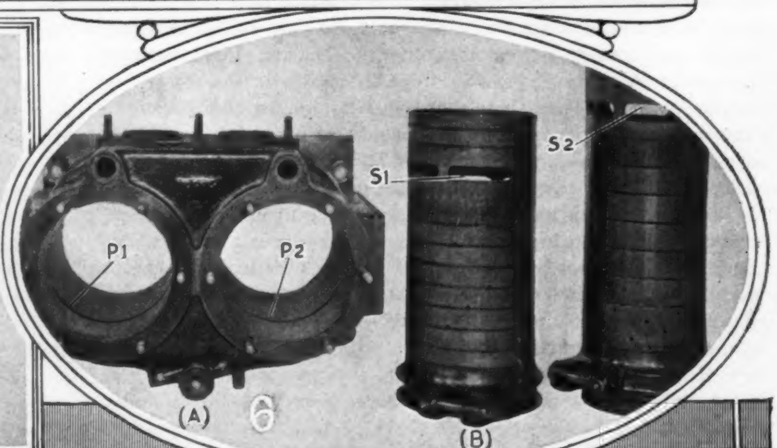
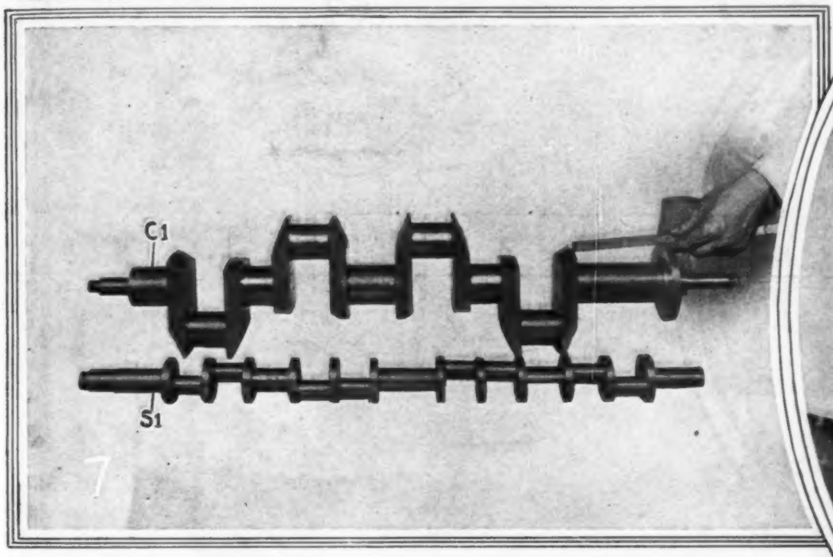
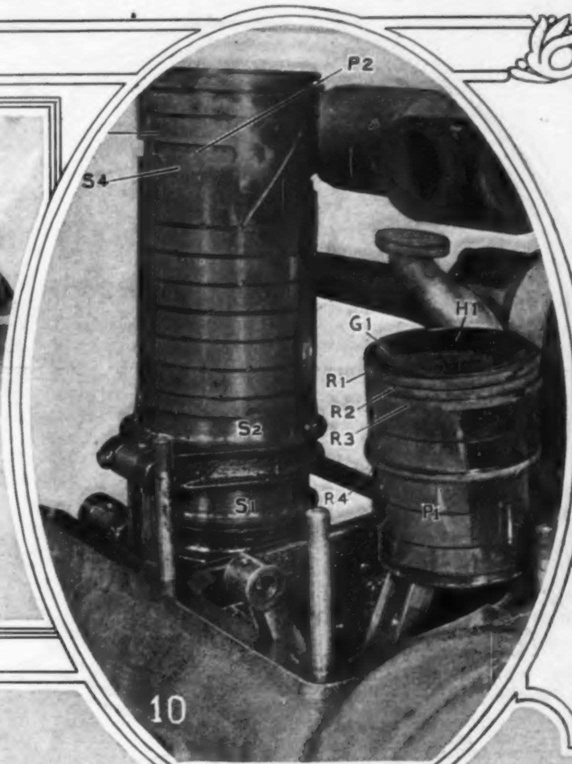
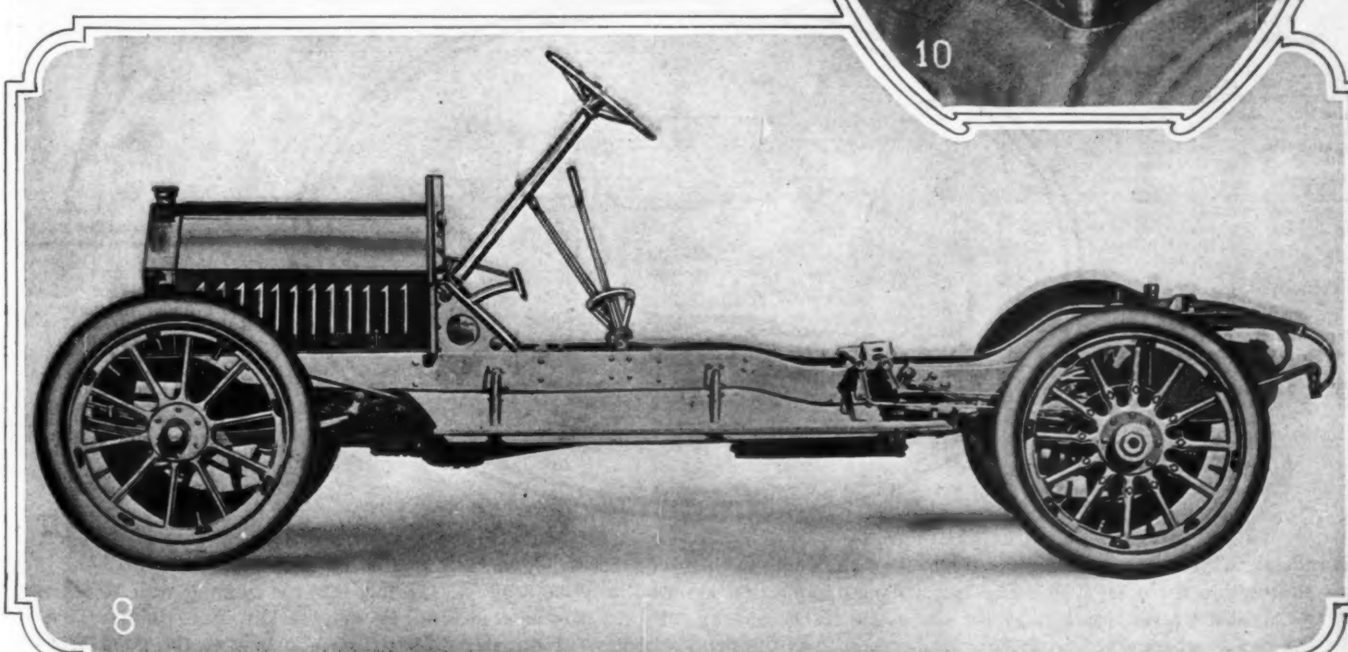
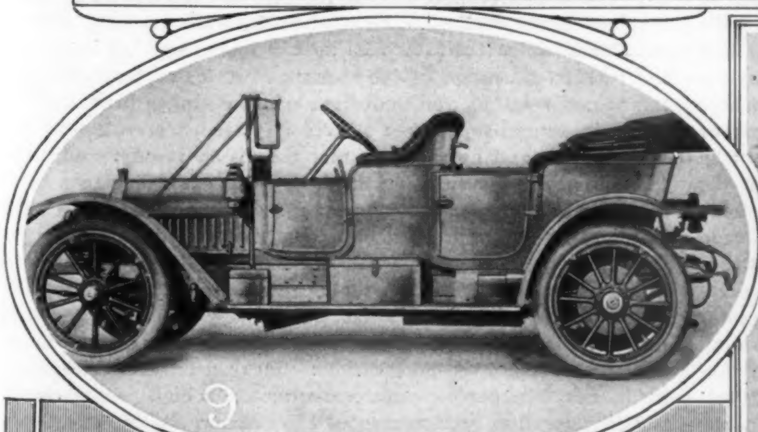


Fig. 2—Showing one pair of cylinders with the sleeves in place and the heads removed indicating the condition of the bearing surfaces at the expiration of the test
Fig. 3—Looking at the right-hand side of the Stearns-Knight chassis
Fig. 4—Looking at the front axle, showing the method of construction
Fig. 5—Showing the four cylinder heads as they were taken off the motor and the condition of the junk rings and other wearing surfaces at the time
Fig. 6—Showing one pair of cylinders and one pair of sleeves and the condition of the surfaces at the expiration of a test run









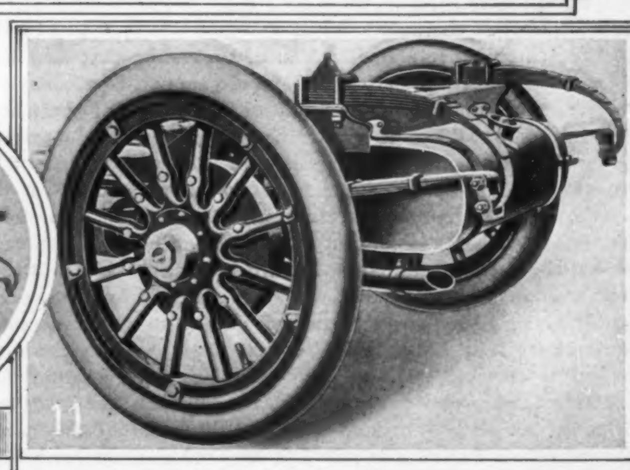
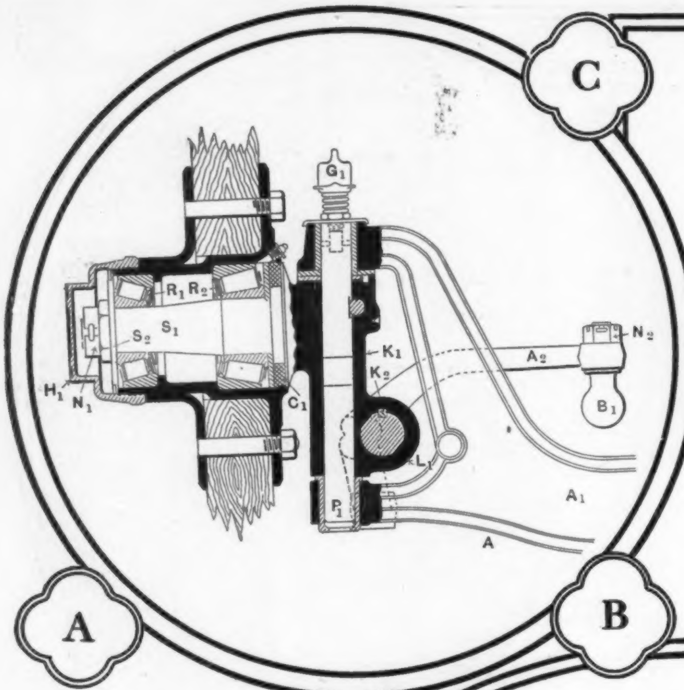
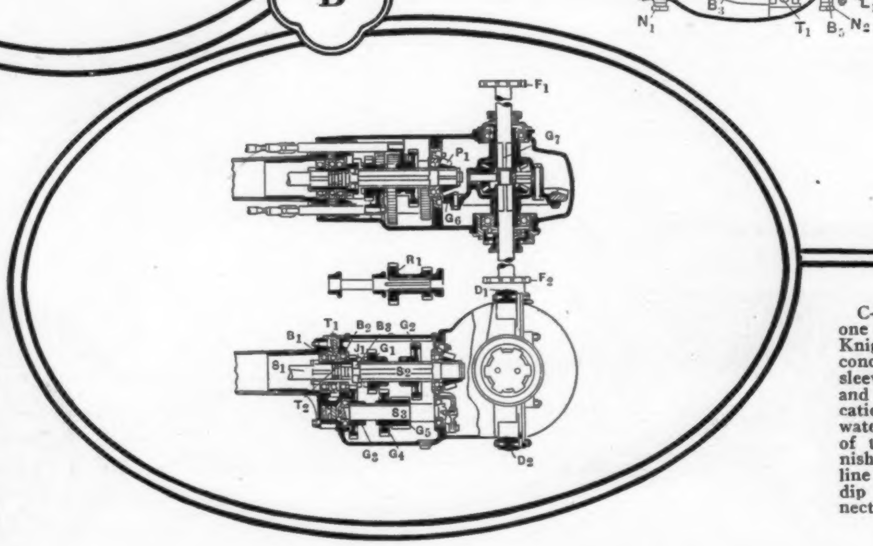


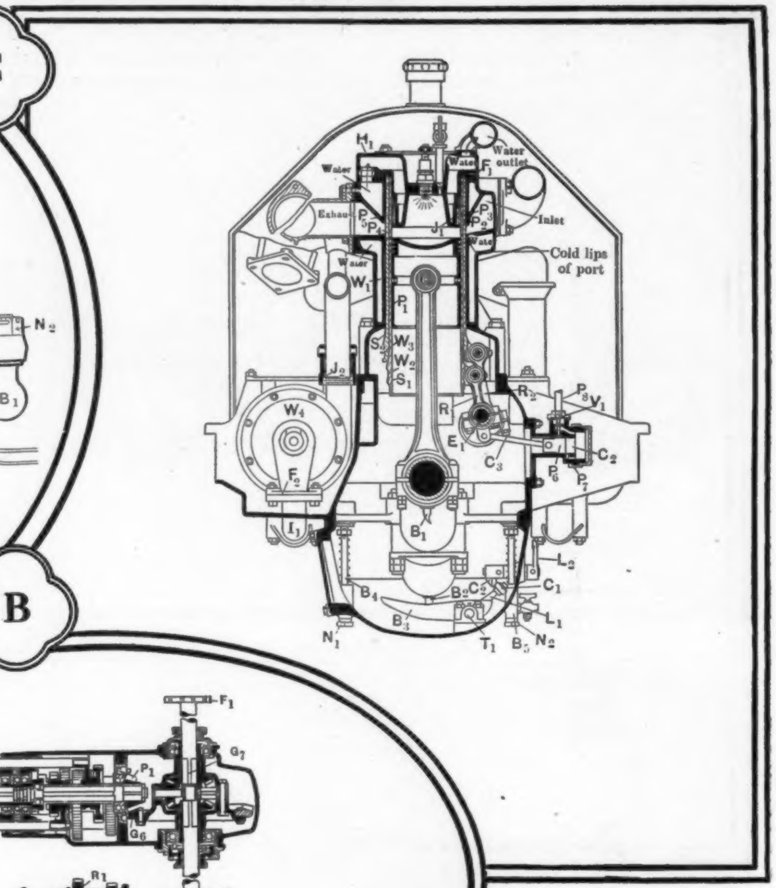
Fig. 7—Presenting the crankshaft and eccentric shaft of the Stearns-Knight motor, showing a bearing on each side of each pin and a 5½-inch bearing at the flywheel end of the crankshaft. Fig. 8—Looking at the left-hand side of the Stearns-Knight chassis
Fig. 9—New Stearns-Knight automobile of the foredoor type with a three-quarter elliptic rear suspension and a half-elliptic front suspension
Fig. 10—Showing the front end of the crankcase with one piston in view and the sleeves in position in the concentric relation with the second piston, photographed at close range to disclose the character of the bearing surfaces and the excellence of lubrication
Fig. 11—Looking at the back of the car, showing the method of suspending the gasoline tank and other details



A—Front axle sectioned through one wheel and knuckle, showing Timken roller bearings and methods of mounting



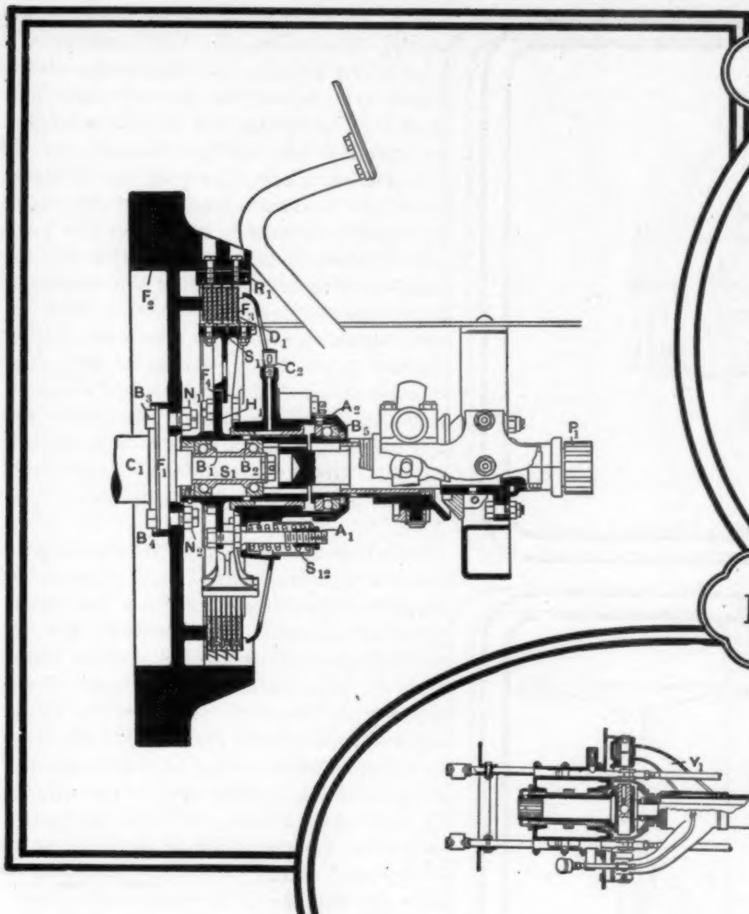
B—Section through the transmission gear in two planes, giving the relation of the same to the live rear axle



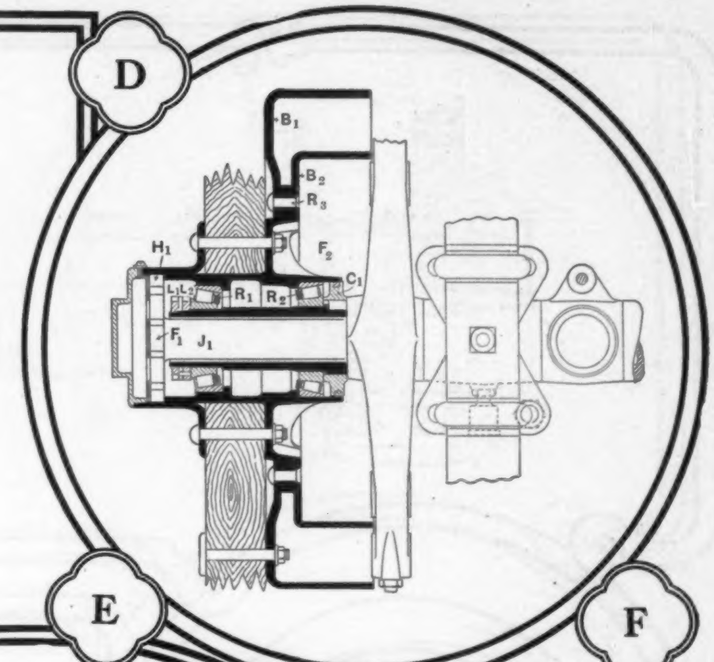
C—Cross-section through one cylinder of the Stearns-Knight motor, showing the concentric relation of the sleeves with the cylinder and piston, methods of lubrication, the mounting of the water pump and the placing of the air pump which furnishes pressure to the gasoline tank, also the adjustable dip for lubricating the connecting rod large ends

the radiator with an upward sweep at the back of the pump to the axis of rotation thereof. The pump has a flange connection at F2 and a packed screw joint at J2 for the outlet. The capacity of the pump has been fixed with particular reference to the performing characteristics of the sleeve type of motor, and one of the most marked characteristics of this motor is indicated by the use of a comparatively small radiator, suggesting that heat loss to the water jacket is relatively a limited quantity, to account for which requires that a further study of the design of the motor be indulged in. When it was at first suggested that a pair of sliding sleeves be placed in concentric relation with the piston in the cylinder of a motor, the state of the art was such that the experts of that time were fearful of the result. They were unable to see wherein a plurality of joints between the flame and the water-jacketed metal could be turned to advantage, and they were wont to point out that the heat absorbed by the sleeves would pile up in the sections thereof, and an over-heated motor would be the result. Chagrin must have been their lot, for in all truth this sleeve type of motor is remarkable for its cold performance, and come to think of it, the elements for cold performance are all present, and now that the proof of this happy characteristic is in ample presence, it requires no great knowledge on the part of anyone to point to the fact. It has long been understood by those who are intimate with motor designing that the only reason why water is used for cooling is because the heat that gets into the section of the cylinder wall must be coaxed out again, and this is another way for saying that if we can keep the heat from getting into the cylinder wall, to whatever extent this is done, cooling may be dispensed with. That the thinness of the sleeves contributes largely to the good performance is now appreciated, it being the case that there is no difficulty involved in the cooling problem when the walls are thin, since it is in thick walls that heat piles up and resists tapping away. In the further discussion of the thermic relations as they obtain in this motor it will be well to observe that the sunken head, with its water jacketing, shields the sleeves from the fierce glare of the burning gas, and by the time that the piston recedes under the force of the pressure wave the heat wave has fallen to a level that is well within control under the conditions as they obtain in this example. The high mean effective pressure of this type of motor is in a considerable measure accounted for by the influence of the sleeves on the retention of heat, and we may conclude by saying that the fact that a very small radiator suffices for every need is a staunch argument in favor of high mean effective pressure, economy of gasoline consumption, flexibility in the range of performance of the motor, a high co-efficient of stability, resulting in accentuated hill-climbing ability, excellence of the average road performance, absence of noise or knocking, and carrying this idea to the point of throttling the motor to a standstill on a steep grade results in the power dying out without any bucking or other signs of distress.

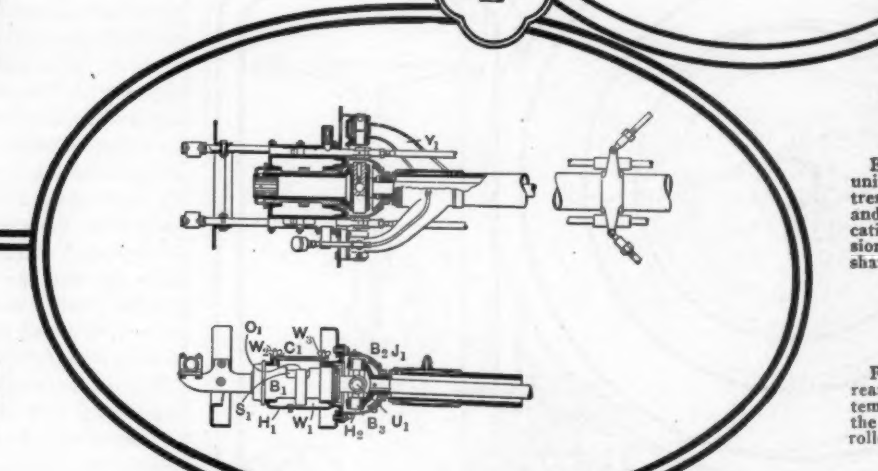
In the operation of the motor it is the plan to work the ac-



D—Section through the flywheel and multiple disc clutch, showing the details of design and the means for disassembling the same



F—Section through one rear wheel, showing the system of double brakes and the mounting of the Timken roller bearings

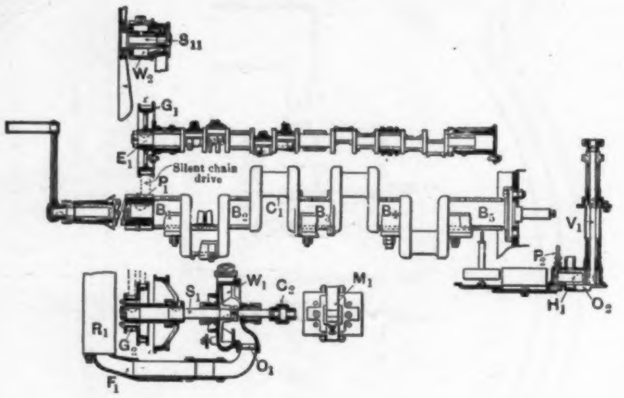


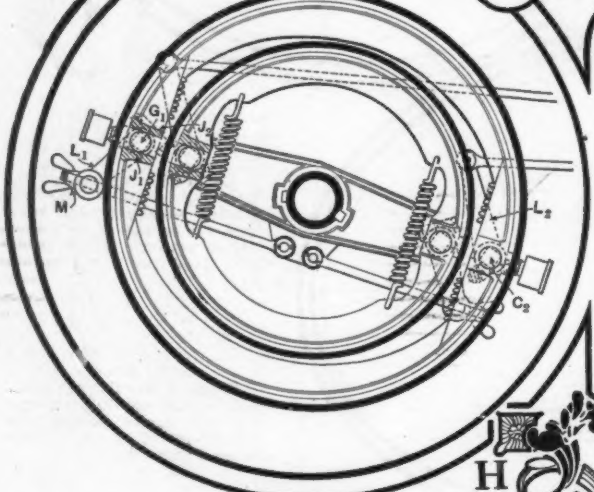
E—Section through the universal joint at the extremity of the torsion tube, and the means of communication between the transmission gear and the propeller shaft

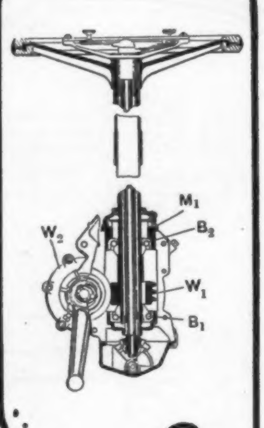
celerator for the control of the air and to maintain the spark at the proper position of advance for the most economical result, but it is a noteworthy fact in practice that the motor may be run fast or slow undei a variety of conditions of the load imposed with the spark fixed, changing speed by altering the air that is admitted to the carbureter, thus showing that the thermic conditions are on a stable basis. The possibilities in the matter of the control of the motor may be seen by making a study of the chart Fig. M, in which it will be seen that the torque curve takes a pronounced upward trend as the speed is increased, thus indicating that the range of stability has been advanced, and it looks, comparing this chart with the conditions as they are indicated in Fig. N, as if the range of stable performance of the Stearns-Knight motor has been advanced by a measure that is not far from 500 revolutions per minute. It is by no means certain that there has been any sacrifice of performance at the lower range of speeds to get this better performance at the higher speed, and the excellence of the work that the motor does on low speed on a long steep grade is the best foundation for this belief. This same characteristic is of much advantage when the road is heavy and the motor is required to deliver maximum power at the low range of speed for a considerable period of time.

In the lubrication of the motor the connecting rods are provided with buckets B1 and B2, there being one on each large end, dipping into tilting troughs B2, swiveling on trunions T1, actuated by levers L1 through cam rollers C1 engaging cams C2, which in turn are actuated by levers L2, of which there is one for each tilting oiler. The motion for the control of the tilting oiling system is imparted by the manipulation of a master lever, which may be placed at any convenient point, as on the dash. It has been found in practice that this method of oiling permits the operator to alter the rate of lubrication fo suit the exigencies of service, and to save a motor from smoking when it is doing mild service in town, which is an important matter in these days when the police regulations everywhere cast doubt upon the expediency of generating smoke in the public streets. The gasoline is fed by pressure to the carbureter and thence to the motor, and the pressure in this particular motor is maintained at one pound per square inch through the good office of a piston P6, which plays in a little air cylinder C2 bolted on the face of the crankcase in the vicinity of the eccentric shaft, and motion is imparted to the piston P6 by a connecting rod C3, which in turn takes its motion from an extension of the connecting rod R1 of the long sleeve S1. The little piston P6 in the air cylinder C2 uncovers a port P7 to admit air, and as the piston travels in the direction of the head after it covers this port the air is compressed when it passes by a check valve V1 into a pipe P8, thence to the gasoline tank, but a pressure gauge is placed on the dash for the purpose of showing the extent of the pressure and indicating to the operator of the car that all is well.

Before departing from the cross-section Fig. C it will be to the







G—Assembly drawing of the rotative members of the Stearns-Knight motor, showing the relations between the crankshaft, eccentric chaft and auxiliary shafts

H—Section through the brakedrums in the plane of the wheel, showing the means for adjustment and other details

I—Section through the steering gear, showing substantial construction and a means for taking up lost motion

point to call attention to the method of fastening the lower half of the crankcase to its mate by means of long bolts B4 and B5, of which there are six, the arrangement being such that the lower half may be dropped down if the knurled holding nuts N1 and N2 for each holding bolt are unscrewed, but in order that this plan may be carried to a successful issue the connections for the lubricating system are so contrived that the joints are automatically made or broken, so that the operator is permitted to get at the working parts of the motor without having to consider the breaking of these joints, notwithstanding the fact that all of the lubricating piping is within the crankcase, and the oil is circulated through piping that passes from the lower to the upper half.

How the Rotative Members of the Motor Are Arranged and Related to Each Other

Referring to Fig. G of the assembly of the rotative members, it will be seen how the crankshaft C1 rotates in five main bearings B1, B2, B3, B4 and B5, and Fig. J is a working drawing of this crankshaft giving the dimensions, and attention is called to the fact that the crankshaft is of unusually stout construction with a 5 1-4 inch by 2 1-4 inch main bearing adjacent to the flywheel, while the other main bearings are graded off to 3 inches by 2 1-2 inches at the middle, 2 9-16 by 2 1-2 at the front end, and 2 inches by 2 1-2 inches for the intermediate bearing. The connecting rod bearings are 2 1-2 by 2 1-4 inches, and the cheeks of the throws are 1 inch thick by 3 3-8 inches the other way, excepting that the cheeks facing the midship bearings are flanged out to 4 1-4 inches, it being the case that thrust is taken by this bearing only, and the faces are made considerably wider for the purpose of resisting this thrust. What the detailed drawing shows is that the unusually large torquing moment of this type of motor demands particular treatment, and in addition to placing a bearing on each side of each throw the strength of the crankshaft has been enormously increased not only by using a liberal supply of metal under well-directed conditions, but in the selection and use of specification nickel steel as well.

Referring back to Fig. G it will be seen how the eccentric shaft E1 takes its drive by means of a silent chain from the pinion P1 to the gear G1, and the drive for the auxiliary shaft S1 is through a silent chain from the gear G2 to the other half of the pinion P1. The shaft S1 drives the water pump W1, the shaft passing through, and the magneto M1 is driven by the same shaft with a coupling C2 interposed. The radiator R1 rests upon a fitting F1, and the piping leads from the under side of the radiator to the entering orifice O1 of the pump. The drive for the fan is by means of a shaft S11 in a lubricated plain bearing, with an oil well W2, the source of power being the auxiliary shaft S1 with a belt transmission. The eccentric shaft is provided with a plain bearing on each side of each throw, and a further study of this assembly layout lends substance to the impression that great rigidity is aimed at. At the right-hand side of the layout a vertical shaft V1 reaches down to drive the oil pump O2, the latter being of the gear type, but it differs from oil pumps in general in that the two gears are of dissimilar sizes, the smaller of which is on the end of the vertical shaft, and the large gear serves as a magazine, taking the oil into the housing, delivering it through a circular path to the cored hole H1 within the gear, and there being a plurality of delivery orifices around the web of the gear, oil is delivered to the pipe P2 at timed intervals according to the registry of the holes in the web of the gear. It was found in the course of the experiments that even a ball bearing in the fan drive was too noisy to tolerate, and a plain bearing with automatic means for lubrication had to be substituted instead.

From the motor to the clutch, nested in the flywheel as shown at Fig. D, is the course of the torquing increment of the power on its way to the live rear axle, and referring to this clutch it will be seen how it is assembled on ball bearings B1 and B2 on the stub S1 of the crankshaft C1, back of the flange F1, to which the flywheel F2 is bolted by means of bolts B3 and B4 with locking nuts N1 and N2 to maintain tightness. The clutch is of the multiple disc type, with fabric facings F3 on the metal discs D1, and the drive is through the ring R1, interrupted by the discs as referred to, to the spider S11, which is flanged at F4 to the housing H1, and pressure is exerted on the discs by springs S12 with adjustments A1, by means of which tension may be varied to suit the exigencies of service. The reaction of the clutch spring is

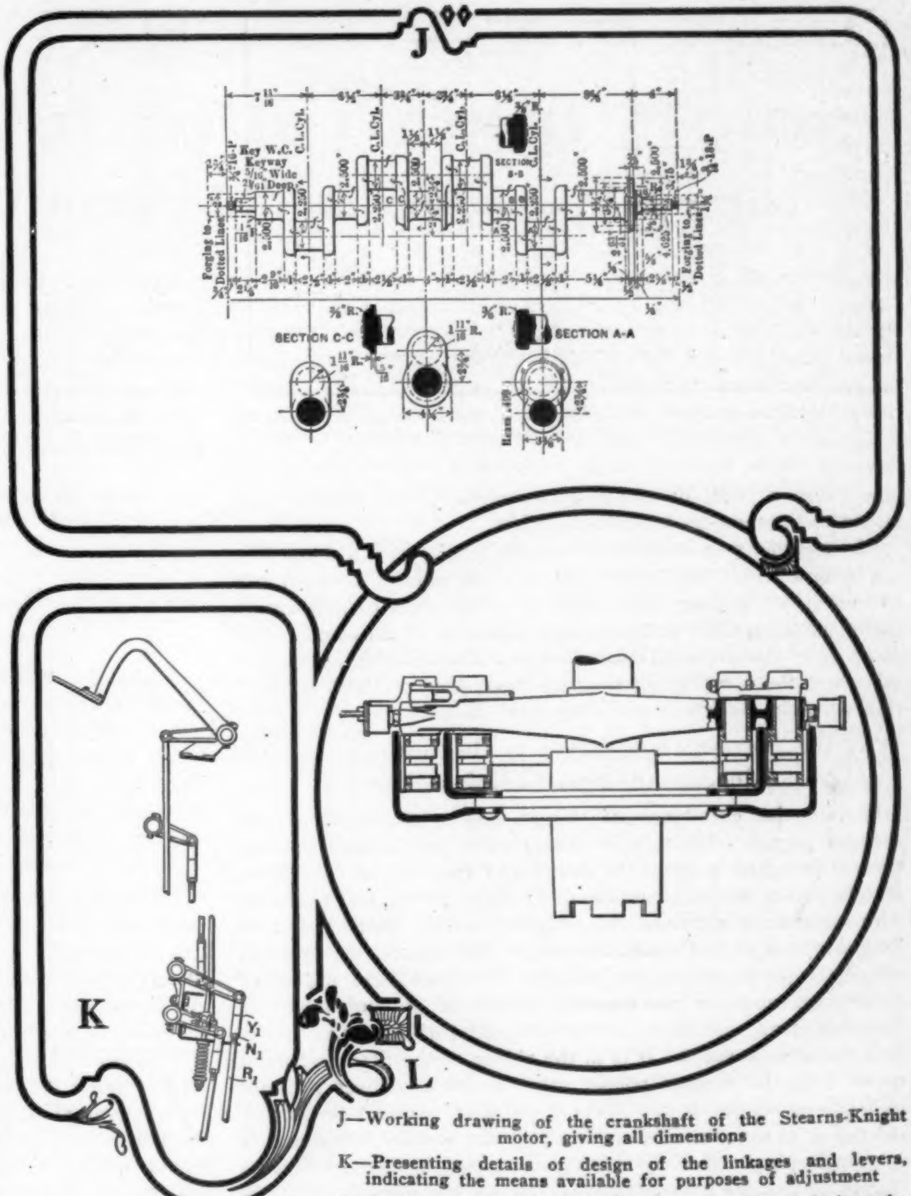
taken care of by the thrust bearing B5, which is also provided with an adjustment A2. Lubrication is handled through the cup C2. One of the important points that this design contemplates is the getting at of the clutch in service, and a study of this section will show that there is compensation sufficient to permit of the removal of the pinion P1, thus freeing it from its mate in a way that will be clear to the reader if he will examine Fig. E of the universal joint in the plane of the yoke Y1, showing how the drive is brought about from the clutch shaft to the joint and thence to the propeller shaft, the latter being in the concentric relation with the torsion tube.

The transmission gear of the three-speed selective type is suspended on the live rear axle, thus composing a part of this unit, and the details of design may best be studied by examining Figs. E and B at the same time. In Fig. E it will be seen that the long bearing B1 is in a housing H1 with an oil well W1 and a ring oiler O1, which is placed to pick up the oil in the reservoir and deliver it on top of the shaft S1. There is a cover C1 over this bearing with wing nuts W2 and W3, which may be backed off at will, thus permitting the operator to gain access to the bearing. The universal joint U1 has large bearings B2 and B3 at the trunnions, and lubricating grease is kept within the universal joint by the retaining ability of the housing H2, which is of spherical conformation with a grease-tight joint J1 between the relating members.

Referring to Fig. B it will be seen that the propeller shaft S1 is supported by annular type ball bearings B1 and B2, and that thrust is taken by the thrust bearing T1. Direct drive is brought about through engaging jaws J1, and the stub shaft is supported by an inserted annular type ball bearing B3, while the thrust of engagement is taken on the thrust bearing T2. The sliding shaft S2 is splined, and the sliding gears G1 and G2 are placed thereon. The lay shaft S3 is in the vertical plane under the prime shaft, and the gears G3, G4 and G5 are put on with splines with a separating tube holding them to their proper centers. The reverse gearset R1, given in a separate sketch, and the bevel drive, with the pinion P1 meshing with the gear G6, are shown in their relation with the differential gearset G7, with the jackshafts terminating in square ends, mounted on annular type ball bearings, ending in flanges F1 and F2 at the extremities where the dog drive engages the hubs of the wheels, thus delivering the power thereto under conditions of great flexibility. The live rear axle is of the Stearns type, with solid I-section forging, yoking around the differential at D1 and D2 in the customary way.

By referring to Fig. F it will be seen how the jackshaft J1 is flanged F1 at its extremity and engages the hub H1 of the rear wheel, and a further examination of this section will show the use of Timken roller bearings R1 and R2, held in place by locking washers L1 and L2, with a closure C1 at the back to keep foreign matter out. The flange F2 of the hub is extended to take the outer brakedrum B1 on one side and the inner brakedrum B2 on the other, they being clamped to the hub flange on finished faces by rivets R3.

To get an idea of the details of the two sets of expanding brakes in the double drums as they are bolted to the rear wheels it will be necessary to examine Fig. H, which is a partly sectional plan in the plane of the wheel and the section Fig. L in the plane of the axle. It will be seen in Fig. H how the adjustment mechanism M1 actuates a lever L1 with a cam C1 pressing against the jaws J1 and J2 forcing the shoes outward, and looking at the diametrical opposite side of the outer brake it will be seen how the lever L2 actuating the cam C2 engages the brakes. The inner brakes are adjusted in precisely the same way, the only difference being that the mechanisms are reversed. Grease cups are placed at points of vantage, the idea being to prevent wear and to save noise.



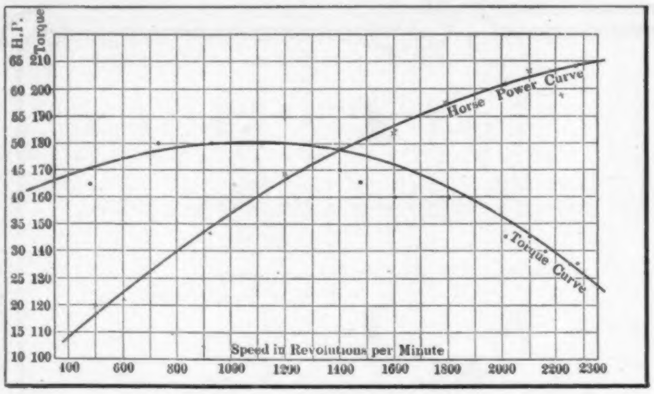
J—Working drawing of the crankshaft of the Stearns-Knight motor, giving all dimensions

K—Presenting details of design of the linkages and levers, indicating the means available for purposes of adjustment

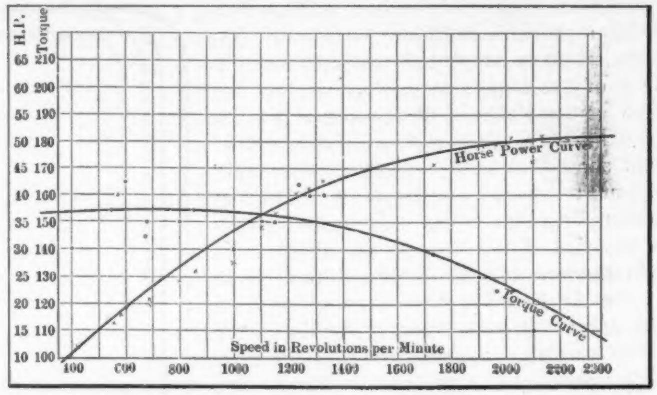
L—Section through the brakedrums in the plane of the axle, showing the substantial bearings and other refinements

Fig. K shows some details of the linkages and the levers and the shape of one of the pedals with adjustable yokes Y1 for the rods R1, with locking nuts N1 at every point.

Referring to the front axle A1 in Fig. A, of the I-section, attention is called to the knuckle K1 with a pin P1 and a grease cup G1 placed at the upper end for purposes of lubrication, and to the knuckle spindle S1 with Timken roller bearings R1 and R2 in the hub with a safety washer S2 held in place by a locking nut N1 with a hub cap H1 over all, and a closure C1 at the back to exclude dirt. This axle is of the Elliott type, and the distance between the yoke supports is adequate for every end. The steering arm A2 is a taper fit in the knuckle lug L1, and it is prevented from turning by a key K2. The extremity of the steering arm terminates in a large diameter ball B1, which is of hardened



M—Torque characteristic of the Stearns-Knight motor given to be compared with the torque characteristic of the Stearns poppet valve type of motor



N—Torque characteristic of the Stearns poppet valve type of motor given for purposes of comparison with the torque characteristic of the Stearns-Knight type of motor

steel, with a press fit in the enlargement of the knuckle arm pulled to tightness by a locking nut N2.

The steering post is shown in section Fig. I, with a worm W1 engaging a wheel W2, with means for adjustment between cup and cone ball bearings B1 and B2. For purposes of adjustment the mechanism M1 with threaded portions is provided. The spark and throttle levers are in concentric relation within the tube, and the steering wheel is of large diameter with a fluted rim, securely fastened to a substantial dished spider.

Why the Stearns Design Had to Be Revamped to Accommodate the Stearns-Knight Motor

Despite the excellence of design and construction of the Stearns poppet valve type of motor as it was refined through several years of practice, it was found that the new Stearns-Knight motor delivers considerablely more power and performs with an entirely different characteristic in hill climbing and on long stretches of bad roads. As will be well appreciated by those who have given the matter thought, the crankshaft and other rotative members in the torquing system of an automobile, if they fail at all, will do so during the period of maximum power delivery at slow speed. It is in the ability of the Stearns-Knight motor over the Stearns poppet valve motor to deliver a larger measure of torque at the lower speed that required the reconsideration of the chassis designing problem, and the whole matter was finally disposed of by refining and strengthening the Stearns chassis to suit the new conditions, but for the purpose of clearness here it is considered desirable to give the results of tests of the Stearns poppet valve motor and of the Stearns-Knight motor.

The Stearns-Knight motor, which the author examined and photographed after taking it apart, has cylinders with a bore of 4¼ inches and a stroke of 5½ inches, making the cubical displacement 312.082 cubic inches, which would give an A. L. A. M. rating of 28.9 horsepower. The power of this motor as determined by test on February 3 and 4, 1911, was as follows:

Prony Brake Test of the Stearns-Knight Sleeve Valve Motor.

R. P. M	Pounds.	H. P.
480	165	15.8
600	175	21
930	180	33.5
960	180	34.5
1,200	185	44.4
1,335	170	45.3
1,360	180	48.9
1,400	170	47.6
1,440	175	50.4
1,485	165	49
1,600	160	51.2
1,620	170	55
1,800	160	57.6
1,950	155	60.5
2,010	150	60.3
2,050	150	61.5
2,100	150	63
2,125	145	61.6
2,125	140	59.6
2,175	140	60.9
2,250	135	60.7
2,280	135	61.5
2,290	140	64.1
2,380	130	61.8

Get-away 165 lbs. torque.

Prony Brake Test of the Stearns Poppet Valve Motor.

R. P. M	Pounds.	H. P.
400	140	11.2
565	155	17.5
590	160	18.7
600	165	19.8
690	145	20
690	150	20.7
800	150	24.8
850	155	27.2
1,000	140	28
1,150	150	34.5
1,200	150	36
1,235	163	40
1,270	160	40.6
1,315	160	42
1,730	138	45.5
1,915	130	49.7
1,965	125	49.6
2,015	125	50.6
2,100	110	46.2
2,140	120	51.3
2,220	115	51

The poppet valve motor has four cylinders with a bore of 4½ inches and a stroke of 4⅝ inches, with an A. L. A. M. rating of 32.4 horsepower. It will be seen that the poppet valve motor is of larger bore than the four-cylinder Stearns-Knight motor, and comparing the power of the two motors at one point only for the moment, the Stearns-Knight motor delivered 44.4 horsepower at 1200 revolutions per minute, whereas the Stearns poppet valve type of motor delivered 36 horsepower at the same speed, and the Stearns-Knight motor delivered a torque of 170 pounds, whereas the poppet valve type of motor delivered a torque of only 150 pounds at 1200 revolutions per minute. The maximum power of the Stearns-Knight motor was 64.1 horsepower at 2290 revolutions per minute, and the maximum power of the poppet valve type of motor was 51 horsepower at 2220 revolutions per minute. In a further comparison of the characteristics of the two motors reference may be had to the speed torque curves, as shown in Figs. M and N, which is the most fitting way of disposing of the matter.

Proper Form of Carbureter Cock

IT is not uncommon, in connection with carbureters, to observe that the cocks are of the sort usually found on gas fixtures and other work in which the ills of vibrations are not figured upon. For carbureters it is scarcely to be expected that the ordinary form of cock will do the work without giving a certain amount of trouble, and the proper form of cock should be one provided with a spring-locking device, so contrived that the cock cannot jar loose. The lock consists of a pin in the stem of the valve which engages a nick in the housing. When the valve is turned the spring compresses enough to allow the pin to slide out of the notch in the housing without any trouble at all. The crank on the stem is also weighted, and the weight hangs downward when the cock is in the closed position. This is an additional safeguard that is of good value, and the cost is really nothing extra. If all cocks are so devised, it is then that the autoist can see, at a glance, if the cocks are opened or closed.

Columbia Out with Knight Motor

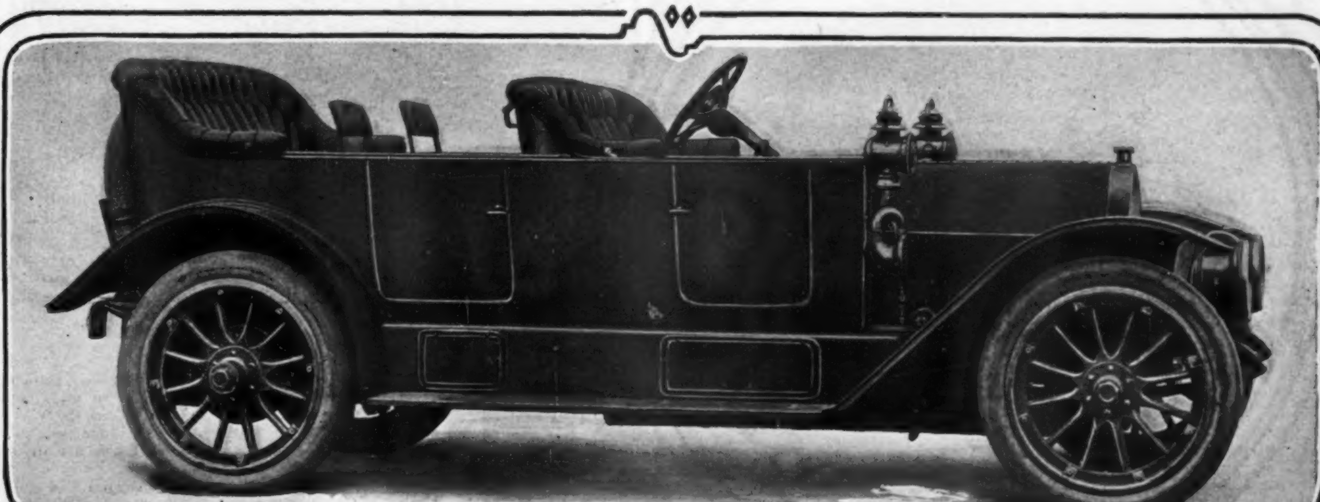
Holding Closely to the Latest English Version

Illustrating and describing the Knight motor used in the new high-powered Columbia car for 1912, showing close agreement between Columbia practice and the work that is being done in England under the direction of Charles Y. Knight, of Coventry, the modifications, such as there are, being in the chassis, for the purpose of bringing the same up to the new requirement in view of the characteristic of the sleeve type of motor and for the purpose of harmonizing the existing relations. The finished article is designed to conform to the demands of American road work, following along the lines that are characteristic of Columbia automobiles as they are known to the industry.

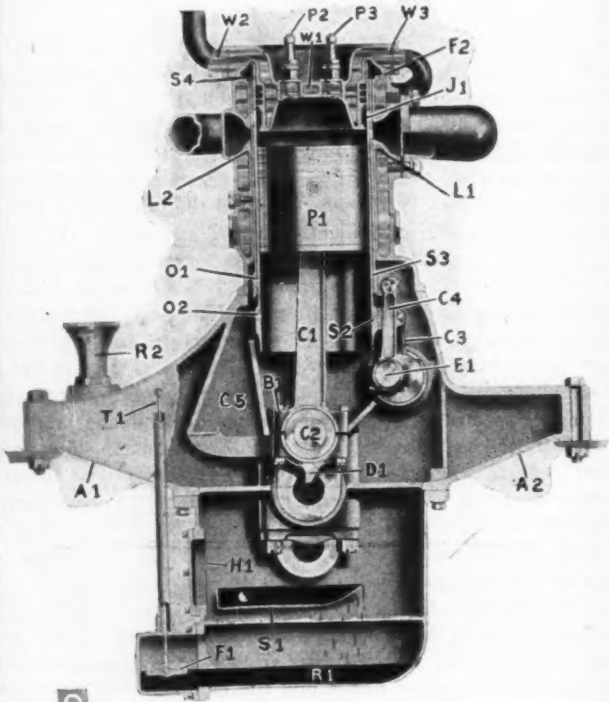
SIGNIFICANT of the trend in motor work, the new Columbia-Knight motor as made by the Columbia Motor Car Company, of Hartford, Conn., is here presented, the motor being of the four-cycle type with cylinders cast in pairs, with an A. L. A. M. rating of 38 horsepower, but the power delivery will be that due to a bore of a 4 7-8 inches and a stroke of 5 1-8 inches. The actual power, according to tests made, ranges between 70 and 85 horsepower. While the motor follows the general lines as practiced under the direction of Charles Y. Knight in his work abroad, an effort has been made to reduce this practice to conform to the requirement from the point of view of this company, and Charles E. Reddig, chief engineer of this company, went into the matter at some length with Inventor Knight, and agreement was reached between them to the furtherance of the plan. The experiences that were gained at Coventry in the working out of the Daimler-Knight motors were taken advantage of in the designing of the Columbia-Knight motor, and in the materials as they are used in the newer effort, there is close agreement with the plans that have served abroad.

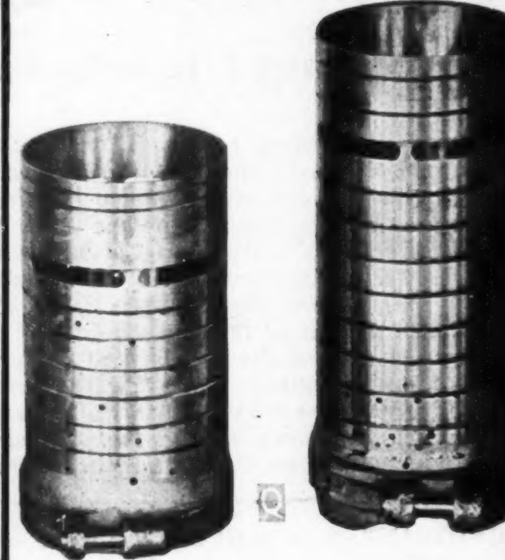
The details of design and construction of the new motor may be clearly appreciated by an examination of Fig. O, showing a section through one of the cylinders at right angles to the plane of the crankshaft. The piston P1 is shown at the top of the stroke, and the connecting rod C1 of the I-section has a split enlargement, and clamping of the crankpin bearing C2 is accomplished by means of four through-bolts B1, etc., using plain bearings and white metal lining. A dipper D1 scoops oil out of the adjustable receptacle S1, and the excesses of lubricating oil fall down into the oil reservoir R1, and the quantity of oil present in this reservoir is indicated by the position of the tell-tale T1, which is actuated through the buoyancy of the float F1 in the manner as shown. Referring to the sleeves in their concentric relation to the piston in the cylinder, the long sleeve S2 on the inside is actuated by the connecting rod C3, and the short sleeve S3 between the long sleeve and the cylinder is actuated by the connecting rod C4, both connecting rods being given reciprocating motion by the eccentric shaft E1, and power is transmitted to this shaft from the crankshaft by means of a silent chain, engaging suitably contrived gears placed in an oil-tight housing at the front end of the motor. Recognizing the necessity of maintaining good conditions of lubrication of the sleeves, the chamber C5 is fashioned in the crankcase, and the oil that reaches this chamber is guided in its upward travel reaching the point O1 for the lubrication of the outer sleeve, and the point O2 for the lubrication of the inner sleeve, and the oil thus applied to these surfaces is drawn up between the sleeves and between the outer sleeve and the cylinder wall, maintaining an even coat of the lubricating oil over all of the surfaces, so regulated, however, that a smoking exhaust is avoided. Some of the lubricating oil reaches the surface S4, and experience shows that the junk ring J1 is maintained in a good state of lubrication at all times, but since all of the lubricating oil that reaches the junk ring surfaces must come into contact with the packing rings above the junk ring it goes without saying that these packing rings are properly lubricated also.

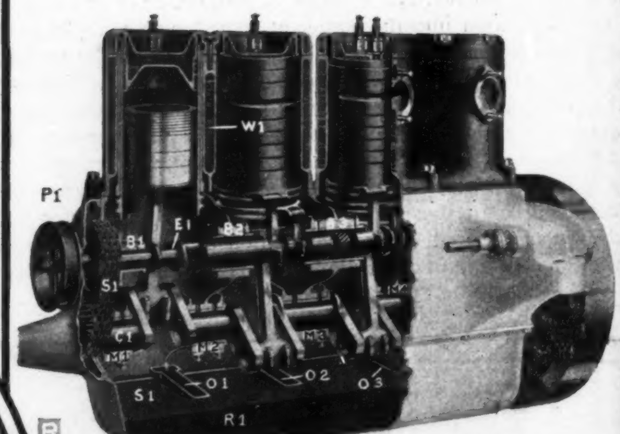
It will be seen how the spark plugs P2 and P3 are screwed into the detachable cylinder head, and attention is called to the water jacket W1 of the head, circulating water all around the spark plugs, thus overcoming one of the little difficulties that was



Columbia-Knight touring car with seating room for seven passengers, which plan is carried out from the appearance point of view in the several models that are placed at the disposal of the patrons of the company







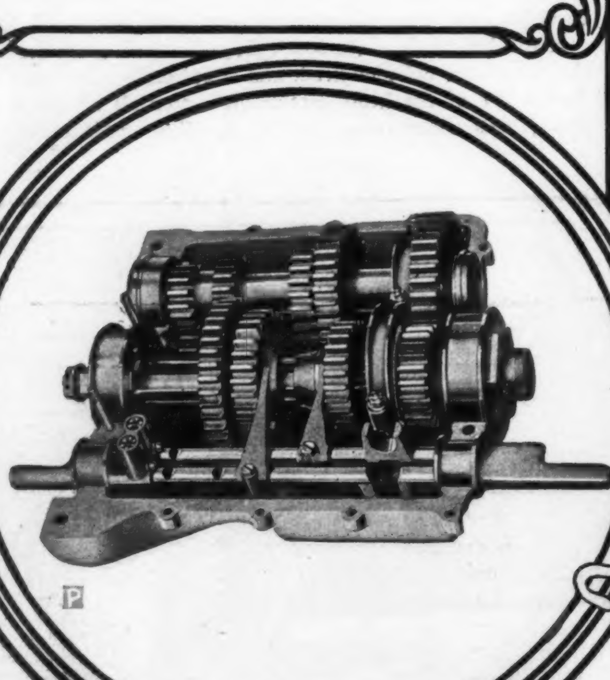
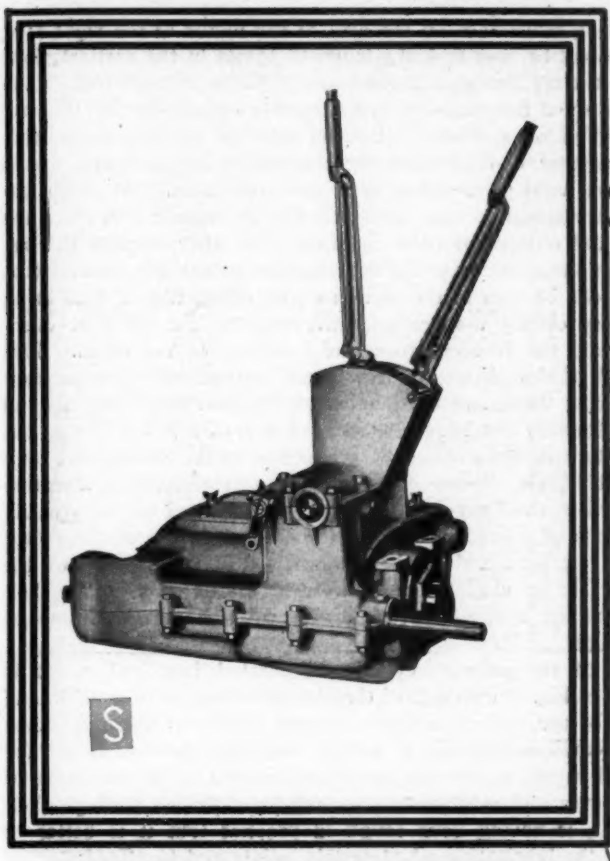


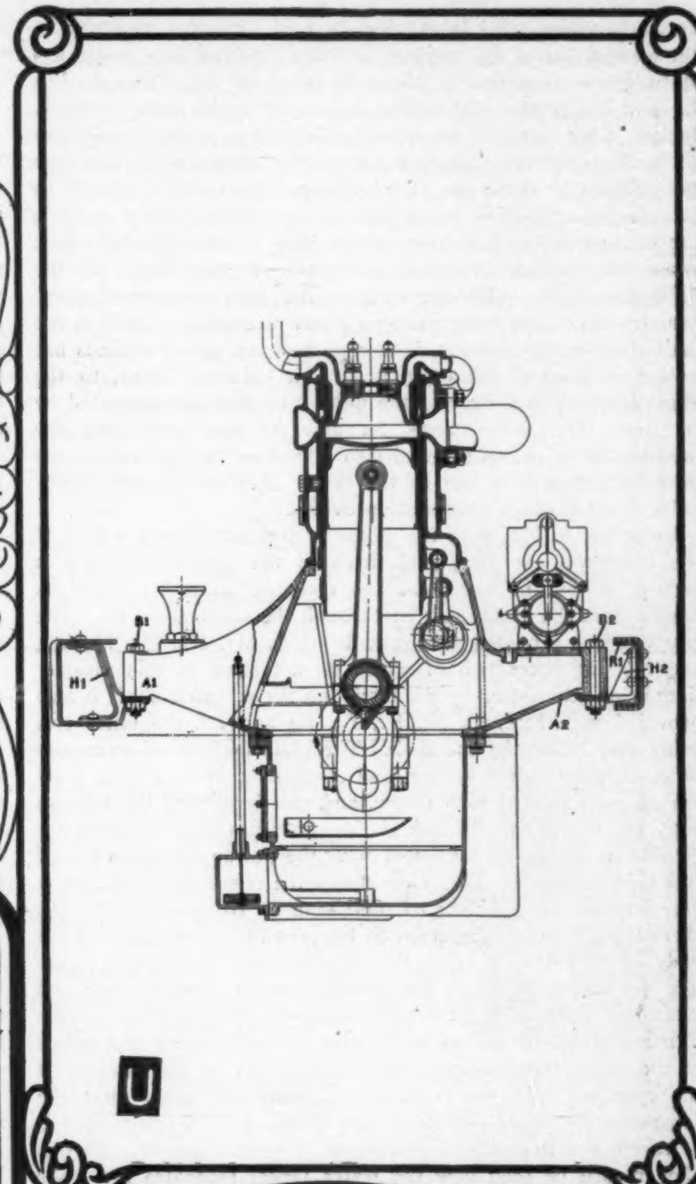
Fig. O—Section through one cylinder, showing the construction of the arms, scheme of oiling and valve mechanism

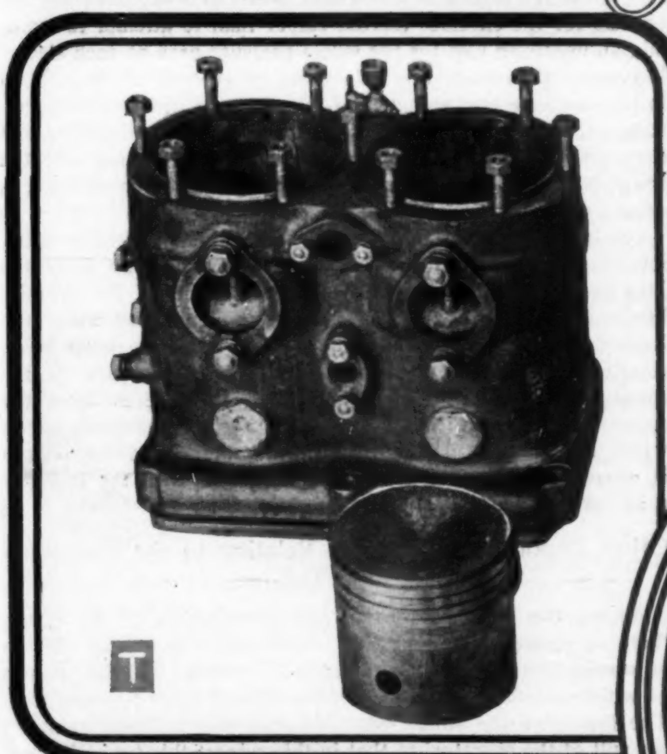
Fig. P—Looking into the four-speed selective type of transmission gear, showing the use of annular type ball bearings

Fig. Q—A pair of sleeves taken from the motor showing the slotting for the ports and grooving to accommodate lubricating oil

Fig. R—Elevation of the motor in part section, showing the relative position of the eccentric to the crankshaft and the silent chain drive between them







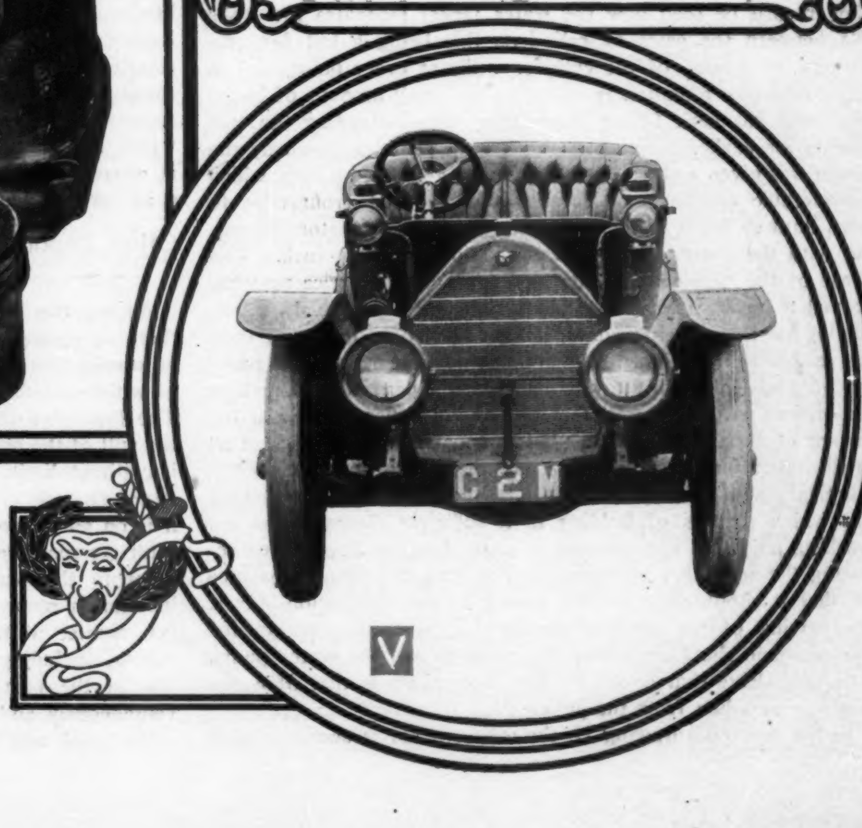


Fig. S—Exterior view of the four-speed transmission gear, showing the arrangement for the levers as they come through the floor in the middle of the body.

Fig. T—One pair of the twin cylinders of the motor and one piston also showing the holding bolts for the cylinder heads

Fig. U—Section of the motor through a cylinder, taken from the drawings, showing the uniformity in thickness of the walls and design features throughout

Fig. V—Front end of the Columbia-Knight automobile, depicting the general appearance of the car

formerly experienced in the Knight type of motor, resulting in the melting out of the spark plugs after a certain time in service. A further examination of the water jacketing shows that the lips L1 and L2 of the inlet and exhaust ports have been carefully looked after with a view to maintaining proper conditions of cooling, and the passageways for the incoming mixture and the exhaust products are of smooth and symmetrical shape. In this design of Knight motor the water connections W2 and W3 are flanged to finished faces on the sides of the cylinder heads, rather than taking a position on the top of these heads. In the designing of the cylinders, some of the early difficulties in the foundry have been overcome by a closer attention to detail in the matter of coring, and it will be seen how the cylinder heads are bolted to finished faces F2, making a "ground" joint, to the elimination of packing, and the difficulties that are suggested by its use. The motor arms A1 and A2 are cored and the breather R2 is shown screwed into a boss on the top side of the arm A1. Access is had to the crank chamber through handholes H1, for which covers are provided.

Referring to Fig. R of the motor in perspective with a part of the crankcase cut away and three of the cylinders shown in section, it will be seen how the eccentric shaft E1 takes its power from the crankshaft C1 through the silent chain S1. The crankshaft is provided with main bearings M1, M2, M3, M4, M5 and M6, the latter two of which do not show in this illustration, being covered up by the shell, and the eccentric shaft is also provided with bearings B1, B2, B3, B4 and B5, the latter two being also hidden by the shell. The crankshaft is of unusually large diameter, bored hollow, and considering the use of a bearing on each side of each throw, and the rigidity of the bearing supports, it will be seen that the designer has filed his brief for rigidity in a manner consistent with the power characteristic of this type of motor. This view shows the commodious oil reservoir R1, and the positions of the tilting oil troughs O1, O2, O3, there being four, also a screen S1 between the oil troughs and the body of oil below, it being the idea not only to carefully regulate the supply of oil to the several bearings, but to filter and clean the same as it is directed back into the reservoir. This illustration affords an excellent idea of the general appearance of the motor, there being a certain symmetry of the exterior of the cylinders, and the crankcase is extended up to meet the somewhat shortened cylinders, thus giving an appearance that is at variance with common practice in motors in general. In this view it will be seen how the water jacket separates the walls W1 between the pairs of cylinders, this being a bid for uniformity of cooling of the cylinder walls at every point, and in this connection attention is called to the small amount of clearance that has been found practicable, notwithstanding the fact that in the earlier practice of the British Daimler Company the piston was given a clearance of as much as .012 of an inch, which considerable amount of clearance was reduced from time to time, until to-day it is not uncommon to see these motors operating with the piston clearance reduced to .004 of an inch. This phase of the designing problem led to another practice that has proved to be efficacious, in which the pistons are backed off, excepting on the pressure zones, and in view of a desire to limit the reciprocating weight to the greatest possible extent, this backing off idea lent facility to the plan, since it permitted of making the pistons so thin of wall that they might deflect a little at the instant of maximum pressure; but this makes no difference at all in the operation of the motor, since the taking on of a slightly elliptical shape is compensated for by the amount of the backing off, which permits of holding to a sufficient clearance for all working purposes, and the gain is marked in the direction of reducing the secondary moments, thus making the running balance all that it should be. In this motor, as the illustration shows, the driving of the rotative members is by a silent chain for the eccentric shaft, including the magneto and the water pump. The only drive that is not by the silent chain is that of a fan which is by a belt from the pulley P1.

In the sectional drawing U, the magneto M1 is shown resting upon a finished face on the arm of the motor at the right side, and it will be seen how the magneto comes in the vertical plane above the top flange of the sidebar. This is a direct bid for accessibility of the magneto, and a further examination of this reproduction of a working drawing adds to the conclusion that the designer had in mind the desirability of affording access to every vital part, rather with the expectation that much unnecessary tinkering may be avoided if the operator can see the parts and observe of their condition. In other respects this reproduction of the working drawing shows nothing beyond that which can be seen in the section O, excepting that it does bring out very clearly the perfect uniformity of the walls at every point and the freedom from the bunching of the metal. This method of designing produces better castings with greater ease of making them, and the number of "wasters" that will abound under foundry conditions are reduced to such a low level that the difficulty involved and cost of production of the castings are on a favorable basis. Before departing from this illustration, attention is called to the hanger, or bracket, H1, attached to the arm A1 by means of a holding bolt B1 for the suspension of the motor at the left side, and to the somewhat different shaping of the hanger H2 attached to the arm A2 by means of a holding bolt B2, and to the reinforcement R1 of the chassis frame at this point.

One of the pairs of cylinders separated from the motor is shown in Fig. T with one of the pistons setting in front of it, and a pair of the sleeves as they came out of one of these cylinders is presented in Fig. Q. It will be seen how the pistons are depressed in the heads, and attention is called to the grooving of the sleeves and to a series of small holes drilled through their sections, it having been found in practice that it is better to relieve the lubricating oil at certain points and to afford storage pockets for the excesses thereof rather than to attempt to maintain an unbroken film for the whole pressure area of each sleeve. It is more than likely that this series of grooves as they obtain in the sleeves retard the upward migration of the slowly-moving body of oil and in this way lubrication is rendered stable, and the probability of an excess of lubricating oil getting into the chamber, fouling the mixture and causing a smoking exhaust, is done away with.

One of the cylinder heads is shown in Fig. W tilted to bring into view the cavity C1 within, and to show the joint J1 of the junk ring. Fig. Z gives another view of one of the cylinder heads, bringing into view the pair of packing rings above the junk rings, also the holes for the holding bolts, the latter being clearly shown in the cylinder heads in Fig. T. One of the connecting rods that impart motion to the sleeves from the eccentrics are shown in Fig. X, and one of the connecting rods which are used to impart reciprocating motion to the pistons is offered in AA. The crankshafts, together with the eccentric shaft, are shown in Fig. Y.

Other Important Matters in Relation to the Columbia-Knight Motor

Among the details of design and construction of the motor, there is perhaps no point of greater importance than that as represented in the fact that the cylinder castings and the castings of which the sleeves are made are produced from Swedish iron. The timing of the motor may be varied over a broad range at the will of the operator, so that in this respect this type of motor is without limit, and in the matter of compression, while the motor is "soft" to crank, the torque characteristic indicates that it is on an increasing basis as the speed increases, receding only after the speed reaches practically the working maximum, as this point in the performance is dictated from considerations of lubrication involving the piston travel as it is measured in feet per minute. With every advantage in the direction of favorable timing, including the use of large ports and water-jacketing around the ports, it is found that the motor scavenges advantageously and that the effort required in cooling recedes to a low level, and it is in these directions that evidence comes of

the fact that the motor should deliver a large measure of power per unit of displacement, performing under wide conditions of flexibility, but the point that seems to be of the greatest moment lies in the fact that service does not seem to induce a condition of leakage with its attending loss of power. The accumulation of carbon in the combustion chamber is at a very low rate, and the carbon that gets between the faces of the sleeves is mixed with lubricating oil, and all of it that remains on the surfaces fills in the interstices of the metal, serving as a lubricant on the same principle that graphite is employed in cylinders for lubricating purposes.

The ignition system is the Bosch double outfit with two sets of spark plugs.

From the motor through the clutch to the four-speed selective type (including reverse) transmission gear, as shown in Fig. S, is through rugged mechanism characteristic of last year's Columbia practice, and the nesting of the gears is shown in Fig. P, in which it will be observed that the prime and lay shafts float on annular type ball bearings, the latter being nested in protective housings with closures to retain the grease used in the lubrication of the ball bearings, keeping out foreign matter, and in the shaping of these housings they are so flanged and otherwise provided that the projected area of the pressure surface against the aluminum of the case is maximum and a liberal surface is provided in the planes of thrust. The arrangement of the transmission gear amidship and the placing of the control lever with the emergency brake lever in the center of the body, to be operated with the left hand, leaves a free entrance into the front seats of the car from either side, but it is optional with the purchaser to have the levers placed at the right side in the conventional way. From the transmission gear through the propeller shaft to the live rear axle is the normal course of the torque of the motor, and the axle, being of the full-floating type in a malleable iron housing, shaped for strength, built up in conjunction with tubes under conditions of hot riveting, promises to sustain under the load and road conditions adequately for the end. Access may be had to the bevel drive of the differential housing through commodious bolted-on covers. The differential housing is drop-forged. The pinion and pinion shaft are forged integral, mounted within a cage upon Timken short-series bearings, and may be removed bodily. The bevel drive and differential gear also float on Timken conical roller bearings. The plan of resisting torsion involves the use of a triangular "U"-section pressed steel member tied to top and bottom of axle housing, and leading forward to a flexible connection at a suitably contrived cross bar. The brakes are of large diameter on the rear wheels, and compensation is through a whiffletree transmitting the effort by rods to pedal and lever. The wheels are 36 inches in diameter, and the wheelbase of this model is 129 inches.

The general appearance of this car, looking at the front, is shown in Fig. V, and the I-section front axle of the Elliott knuckle type is in plain view with substantial drop-forged knuckles and stout knuckle arms with a cross rod in the protected position back of the axle, and a straight drag rod leading to the steering arm interpreting the effort of the driver exerted on the steering wheel in the maneuvering of the car. The axle is of the drop type forged in one piece with integral perches for the springs, and the half-elliptic springs in front are designed in view of the condition of constant loading as represented by the motor for the most part, care having been taken to fix the load per inch of deflection of the front springs within the zone of stability, remembering that any pitching that is induced at the front end of the car complicates the body movement at the back, making it extremely difficult for the designer to promise easy riding qualities. Having fixed the spring condition at the front on the basis of an even platform, it remained for the designer to so fashion the back springs that the vertical oscillations would be on an agreeable basis, perhaps in the neighborhood of one and a fraction per second. The importance of utilizing the large amount of power that is promised by the use of the Knight sleeve type of motor has made it necessary to study the distribution of weight in the chassis, and account has been taken of the fact that a mere low center of gravity has little to do with the truly good performance that practice supports. Having extended a due measure of attention to questions of clearance, it remained to distribute the mass as it is represented by the power plant, so compacting it as to avoid top-heaviness; in other words, the machinery equipment, as nearly as possible, forms a sheet in close proximity to the center of gravity, resolving the latter from the increments of a closely related mass rather than otherwise. It would be too much to expect that a motor with a high torque characteristic could be used in a chassis and have it perform with entire satisfaction without taking due account of the relating situations, and it has been the purpose of the designer in this case to harmonize these relations and obtain the best result.

From the Point of View of the General Appearance of the Car

An examination of the title illustration will suffice to show a flush side type of body of the vestibule design with fore doors, and as a conspicuous incident of this design the great width of the doors may be looked upon as a factor. The space within the vestibule is considerably more than that of last year in this make of car, and comfort from the point of view of the occupants of the automobile has had a wide influence upon the activities of the designer. The cushions of the seats are 10 inches high, with a smart pitch to the rear and the use of long coil springs in conjunction with the best grade of curled hair has fortified the undertaking. The seven-passenger body as shown is almost severe in its straight-line effect, and a part of the satisfaction that has been obtained is due to the continuation of the line of the bonnet in the plane of the flush side paneling of the body. Having designed the front seats with a view to comfort in driving, which is apart from the consideration that influences activity in the rear seat work, it remains to state that the rear seats span 53 inches, are proportional in depth, and comfort is further assured by plenty of knee and leg room in the free space in front of the seats.

Among the body options, the six-passenger type is worthy of particular mention, this body being with straight sides without molding or decoration, and the rear seat is 44 inches wide. The extra seats in the tonneau are of the collapsible and folding type, dropping into the floor so that they are out of sight as well as out of the way when their use is not called for.

The close-coupled roadster represents a particularly smart undertaking with room for an extra "case" upon the rear end, with a back and trap-door entrance to the auxiliary storage space which is afforded by the design.

The two-passenger roadster is a strictly gunboat type of car with a large capacity gasoline tank, and a tourist's trunk so placed as to be out of the path of dust and dirt.

In fitting out these automobiles, while it has been the aim to afford to the company's clientele as much of auxiliary equipment as could be foreseen on a conservative basis, the fact remains that there has been a fair attempt to avoid the "undue" loading of the car, and the equipment decided upon in view of this consideration includes a cape top with top boots for all models, demountable quick detachable rims with extra spare carried rim, power tire inflation pump, complete electric lighting equipment, a well-contrived horn, ignition and lighting battery, supplemental to the Bosch high-tension magneto, shock absorbers, robe rails, foot rests, rear hamper for storage, trunk rack, locker for goggles and gloves, a full regular set of tools with proper means for holding them, and among other incidentals a registration plate holder.

In the schedule of the automobiles that will be turned out this year a certain amount of attention is to be given to coach bodies, and of these types of cars as listed in the preliminary announcement mention is made of a seven-passenger limousine vestibule with fore doors, fitted with glass enclosing side storm

panels for the driver's seat, and Berline type double enclosed limousine, straight front and hooded landaulet, not to mention the types of body work that will be entertained in the event of demand.

The Columbia Line Will Include a Poppet-Valve Type of Power Plant

In addition to the new Columbia-Knight type of power plant it remains to state that the company is building a 38-horsepower poppet-valve type of motor with T-head cylinders in which the approved mechanical features of the 1911 Columbia motors have been retained, and the design has been brought up to date in all minor respects. In this motor the cylinders are cast in pairs with a bore of 4 7-8 inches and a stroke of 5 1-2 inches, thus making the A. L. A. M. rating 38 horsepower. The new features of this motor include a pure-air pressure system for the gasoline supply, and a motor-driven tire inflation pump. The carbureter is raised, thus permitting the manifold to be so shaped that "loading" is avoided, and it might be well to say that the pure-air device which furnishes pressure to the gasoline tank is a separate equipment from the power air pump. The carbureter is located on the left side of the motor in the mid position, and the Bosch magneto rests upon a shelf just back of the front arm on the same side of the motor, and by way of an innovation the magneto is provided with a brake to be used in locking the driving shaft in a definite position during the time that the magneto is disassembled from the motor for purposes of inspection and repair, thus assuring the repairman that the timing will be undisturbed, since the magneto may be put back into precisely the same position that it previously occupied, and to release the brake is then the only remaining consideration. The oil pump is driven by a vertical shaft extending down from the camshaft and the pump is located horizontally in clear space between the oil sump and the flywheel. The timer is driven by an extension of the same vertical shaft and it is placed on the top of the crankcase well clear of the flywheel. Looking at the right-hand side of the motor shows the centrifugal water pump in the mid position driven by a shaft with a gear in the halftime train, and the power air pump is placed between the water pump and the rear arm of the motor, taking its drive by means of a gearset with one member on the pump shaft, and by means of a lever that is conveniently placed the gears are meshed when it is desired to operate the power pump. The oiling system in this motor includes a commodious sump in the lower half of the crankcase for the supply of oil, a means for determining the oil level, and facilities for draining out the oil when it is desired to clean the system. The details of the motor are in excellent keeping with the main idea, taking into account the fact that users of automobiles will be safe in choosing a sleeve type of motor on the one hand or a poppet-valve type of motor as a substitute, either of which will fit harmoniously into the chassis and do the bidding of the owner.

Steam vs. Gasoline

There seems to be an idea among the heads of some municipal fire departments that pumps driven by gasoline motors are less effective than those driven by steam. In the adoption of a gasoline automobile fire-fighting system the advantage of having the same power propel the vehicle and pump the water is obvious, and there are many examples of the successful operation of this combination.

INTEREST is being centered in the problems that confront the fire departments of municipalities from the point of view of the substitution of automobile fire equipment for the old kind. Every progressive community fully understands that the automobile fire equipment is better in every way, but among the men who are charged with the various duties involved in the changing over there is an air of uncertainty, due to the fact that they fail to appreciate the significance of certain of the problems, and they are too prone to believe that there is some peculiar merit attached to a steam pump, for illustration, that is found wanting when a pump is driven by a gasoline motor. The probabilities are that quite a number of the activities of these men are based upon mere superstition. The delivery of water from one point to another requires power on the same basis as the delivery of coal, or, for that matter, gold from a mint. The delivery of water or other compounds is at the expense of power, but it is too much to expect that the water delivered will express a preference for a horsepower from a steam engine rather than a horsepower from a gasoline motor. It would be foolish to discuss this matter were it not for the fact that the engineers in the various fire departments are talking among themselves on this basis, and it is a little alarming that some of them labor under the impression that a gasoline motor of a given power is at a disadvantage when it is driving a water pump as compared with a steam engine of the same power when it is used to drive the same pump.

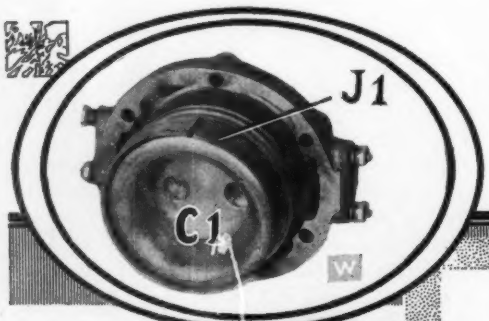


Fig. W—Looking into one of the heads of the motor.
Fig. Y—Showing the crankshaft and eccentric shaft.
Fig. Z—Looking at the head of the motor from another angle.

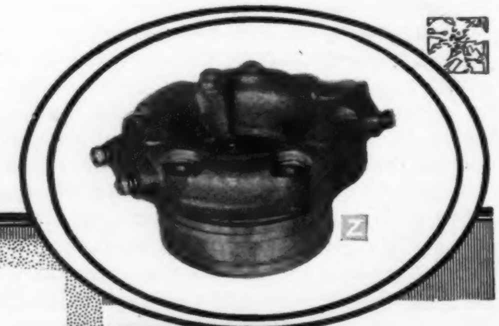
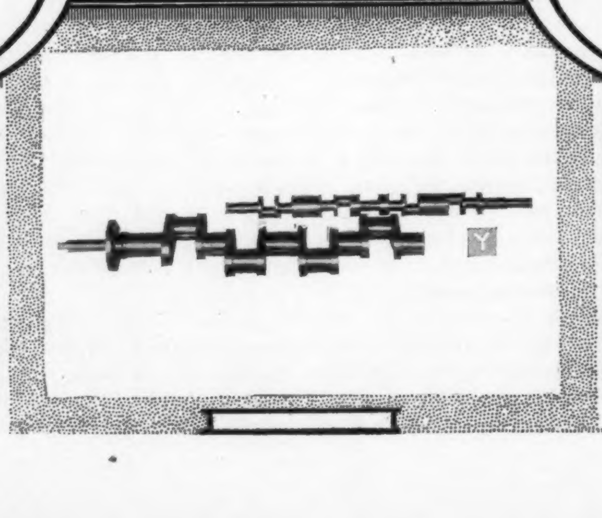


Fig. X—Connecting rod for the sleeves.



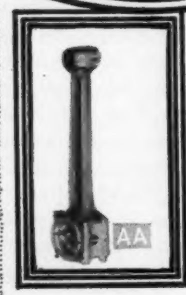


Fig. AA—How the connecting rod for the piston looks.

Adulteration Bane of Good Varnish

Thinning and Binding Materials Play an Important Part

M. C. Hillick discusses the problem of painting and varnishing of automobiles and entertains the reader in a discussion bearing upon the subject of adulteration as it is practiced in paints and varnishes, ending up by stating the relation of the thinning and binding mediums that find a place in this class of work.

TO the automobile owner and the automobile painter the question of purity of paint, color and varnish thinning and binding mediums, consisting principally of turpentine and raw linseed oil, is of the utmost importance. Within the past two years there has developed an increasing complaint concerning the failure of the paint and varnish structure—that is to say, the finish—to wear as all those interested have a right to expect it to wear, and within the past few months there has come an urgent demand for an explanation of the lack of durability of the automobile paint and finish.

There are, of course, many reasons, both logical and, it would seem, convincing, to be offered in justification of the lack of durability of the automobile finish, but probably the foremost reason to-day is that of sophisticated or substitute thinning and binding mediums, confined chiefly, we believe, to turpentine and raw linseed oil. At this writing raw linseed oil in barrel lots is quoted at 90 cents a gallon, and turpentine in five-barrel lots is on the market at 60 cents a gallon. These quotations are considerably lower than those prevailing a few weeks earlier in the season, but they are still sufficiently high to move the unscrupulous manufacture or jobber to resort to adulteration as a means of easing up the market and increasing his profits.

The adulterated raw linseed oil may and often does contain anywhere from 20 to 30 per cent. petroleum in its various forms, and the substitute oils, of which we are just now hearing news in plenty, are often found to contain as high as 50 per cent. of rosin oil or petroleum. The average paint-shop proprietor, or his foreman painter, lacking a definite knowledge of chemistry, is at a disadvantage, acting alone in the matter, in any effort he may make to determine the character of the oil supply. The best he can hope to do, and the very best he can do, in fact, is to deal direct with some strictly reliable jobber, or, better still, with a crusher of established trade reputation. A sophisticated oil, or an oil substitute, containing, say, 25 per cent. petroleum, rosin oil or some other equally undesirable medium, puts the buyer in a position of paying at the rate of 90 cents a gallon for petroleum or rosin oil; and in the event of the adulteration or substitution reaching a 50 per cent. basis it is easy to understand the element of chance introduced. For determining the purity of raw linseed oil a hydrometer, an inexpensive little instrument, may be used with good results. A pure linseed oil, by the hydrometer test, should not vary 1-2 degree from 20° to 60° Fahr. Simple tests for the purity of the oil may be carried out as follows:

Mix equal parts of the oil and ammonia together. When cottonseed oil is present the ammonia drives the liquid to an opaque yellow. Fish oil under the effect of the ammonia grows white. A simple and effective test consists in taking a couple of test tubes and putting a quantity of linseed oil of known purity in one tube and a quantity of suspected oil in the other, then immersing the tubes in warm water for one-quarter of an hour, and immediately upon removal from the water pouring the pure oil into the tube of suspected oil. Should there be existing impurities different colors will form in layers.

Turpentine, the universal and indispensable color and varnish-thinning medium, is at the mercy, apparently, of the adulterators and substitute orators. Sophisticated turpentine, or turpentine substitute is causing more trouble among a very large class of automobile users and painters than almost any other one thing.

Speaking from a practical point of view pure turpentine may be said to be indispensable. It is the paint, color and varnish-thinning medium *par excellence*. To get at the purity and, therefore, the real value of turpentine the hydrometer may very well be impressed into service. Strictly speaking, a turpentine of the greatest use in the finish of the automobile should not register above 31 1-2°, or below 30 1-2°. As a matter of fact, —or, perhaps, we should say, as a matter of business—the automobile painter, and, back of him, the automobile owner, should insist upon 31° turpentine. Sophistication of the turpentine is widespread—countrywide, we should say—and it consists chiefly of mineral oil, which medium, at its best, retards the drying of the pigment and renders its action more or less uncertain.

In turpentine substitutes there are many which contain only perhaps a small percentage of non-volatile lubricating oil which is said to come over in the fractional distillation process used in the manufacture of this material from the crude petroleum. But this minute quantity of lubricating oil is in itself sufficient to render any paint or varnish containing it uncertain in its action and devoid of its maximum durability.

A turpentine substitute composed mainly of a product obtained from the steam distillation of pine strips and logs, commonly known as "wood spirits," and, if pure, will yield very good results, as a rule. Chemists, we believe, claim that wood spirits has greater solvent power than pure turpentine, but it is deficient in those properties which have made turpentine famous the world over.

There is another class of turpentine substitutes, or materials with which pure turpentine is sophisticated, that it is worth while to here briefly consider. These solvents are obtained from coal tar and include xylol, naphtha, tolnol, benzol, and thinners of a similar nature. Practically all of these mediums possess unusually active solvent properties, and while the much lower price at which they are sold is an inducement to certain branches of the trade the inferiority of the mediums for use in the automobile finish is so pronounced that their chief use is confined to the manufacture of varnish removers and for other purposes wherein the durability and working properties and appearance of pigments is not a matter at issue.

A class of turpentine substitutes, or a class of turpentine adulterating mediums, which have attracted large attention, and which are likewise considerably used both as turpentine substitutes and turpentine extenders, to speak in charitable phrase, are derived from crude petroleum by the process of fractional distillation.

In the matter of flash point and solvent properties crude petroleum derivatives approximate very closely—almost precisely, we might say—to the pure turpentine. To subdue the flash point and hold it down the manufacturers arrange to have a certain quantity of heavier oils distilled over, which latter mediums bring the marketable product into close relationship to the naphtha and ordinary kerosene group of oils, and render them unfit, even when employed in comparatively minute quantities, for use in fine automobile paints, colors or varnishes.



A—Building a broken-stone road through swamp in Oxford County B—Crescent Road, Rosedale, Ontario—A beauty spot of the Province
C—On the Queenston and Grimsby stone road in Lincoln County

Ontario, Model of Road Building

Province Has Solved Problem of Highways

Most populous of the Canadian states has 50,000 miles of maintained roads outside the incorporated cities and has spent upward of $40,000,000 to make and keep them. The Provincial Government has contributed over half of the sum mentioned. In parts of the section the clumsy system of working out road rates is in vogue, but the majority of the counties have adopted the most modern system of road building and maintenance. Toronto, magnificently paved itself, is one of the few large cities on this side of the Atlantic that has ever contributed a penny to road work outside its own limits.

TORONTO, July 3.—There are approximately 9000 automobiles in active service within the Old and the New Provinces of Ontario, Canada. For the accommodation of these motor-cars, 50,000 miles of public country highways—exclusive of all city roads—are maintained, of which 40,000 miles gridiron the Old Province and 10,000 miles thread the New Province. All of the work of repairing and maintaining the established thoroughfares and building new ones, is carried on under the direct supervision of Mr. W. A. McLean, C. E., Provincial Engineer of Highways to the Ontario Highway Improvement Bureau. These country roads penetrate through 500 Townships and 37 Counties in Old Ontario; and 8 Counties in New Ontario.

There are portions of the Townships in Old Ontario which still adhere to the feudal basic principle of keeping up the rural roads, the system literally corresponding with that in vogue in certain sections of the States, whereby the farmers "work out their poll-tax," by contributing each their respective share of manual labor. Nineteen Counties out of the 37 have adopted the new County system of road-building. This means that the highways of the nineteen Counties are improved and maintained under the regulation Provincial method. This system embraces three provisions which the road-builders in Counties are compelled to abide by. Each highway must be built either of gravel or macadam; steam-rollers must be used in the process of construction; and the highways must be thoroughly and symmetrically graded. The system in its entirety, as it is found to-day, was adopted in 1901. A summary of expenditures in the Townships of the 45 Counties in the two Provinces shows that cash to the amount of $19,015,343 was paid by the Government for the up-build and maintenance of roads from 1889 to 1908; to which must be added about $750,000 per year during 1909 and 1910. There is now being built an automobile trunk-line road 300 miles long, from Sudbury to Sault St. Marie, and skirting the north shore of Lake Huron, the expense of which falls upon the shoulders of the Provinces of Ontario, the Counties contributing absolutely nothing.

This highway will constitute the finest automobile route in the Dominion of Canada. Independent of this highway, sixteen Counties have put up one-third to the Provincial Government's two-thirds, in an outlay of nearly $4,000,000 for the purpose of building roads. The result is that the highways of these Counties are the best in the Western portion of the Old Province of Ontario. One essential feature of the system of road-building in question is that the Provincial Government will not extend aid to individual Townships. Co-operation must be complete. Every Township in a County must come in as an integral part, or the whole County must stay out.

A single exception to this rule is found in the instance of York County, of which Toronto, with its sublimely paved streets, is the metropolis. Toronto took a hand in building outside of its own municipal limits. This is the only city in the Dominion of Canada that has ever extended financial aid for the purpose of constructing automobile roads not within its own confines. But in this case the city contributed $100,000; the Provincial Government gave $100,000; and the Southern, or lower, half of York County put in $100,000, making a total of $300,000. The Northern, or upper half of the County declined to affiliate, on the ground that its own roads—built out of gravel, and some of which are worse than others—were quite good enough for automobiles to travel over, without plunging into the Treasury.

The $100,000 given by Toronto is absolutely independent of the appropriations made for augmenting and maintaining her own city roads. These comprise within the mnnicipal limits 407.57 miles of streets and 115 miles of lanes. There are 262.13 miles of

D—A fine stretch of road in Oxford County E—Chestnut Park Road, Ontario—A stunning driveway
F—A normal road in old Ontario Province—good automobiling is promised

the streets which are paved and 145.44 miles are unpaved. The kinds and miles of pavements and roadways follow:

Asphalt	118.44	miles
Cedar blocks	17.71	"
Brick	25.41	"
Macadam	45.91	"
Wood and concrete	0.49	"
Stone and scoria block	2.34	"
Gravel	21.35	"
Bitulithic	20.68	"
Tar macadam	3.88	"
Concrete	1.98	"
Asphalt block	4.14	"
Unpaved	145.44	"

The streets designated as being unpaved include quite a number which have been improved by macadam pavement.

The system of paving with asphalt was introduced in Toronto twenty years ago, and every yard of this pavement is laid on a concrete foundation of from four to six inches with a one-inch binder course. The specifications demand a two-inch surface of asphalt.

Such a thing as a paving company securing a contract through political intrigue or graft in the Dominion of Canada is absolutely impossible. Not only have Toronto, Ottawa, Hamilton and Winnipeg asphalt paving and repair-plants of their own, but in the event of a new street being paved, or an old one repaired, the respective municipalities advertise for tenders and the contract goes to the lowest bidder, independent of the city's plant, in case the outside bidder's figures are below those proposed by the city's own engineers.

Ottawa, Hamilton, Kingston, London, St. Thomas and St. Catherine all make use of asphalt for the paving of streets; but the smaller the town, the less asphalt is used, to the advantage of brick and macadam.

The comparison between the maximum, minimum and average prices for paving with asphalt, as shown in a table from 1901 to 1909, follows:

	Maximum.	Minimum.	Average.
1901—Heavy	$2.70	$2.30	$2.54 6/10
" —Light	2.23	1.88	2.04 1/2
1909—Heavy	1.95	1.59	1.72 2/3
" —Medium	1.80	1.40	1.60
" —Light	1.44	1.12	1.28

The extremely low prices shown during the year of 1909 were brought about rather by the keen competition existing among the contractors than by a reduction in the actual cost of pavement. However, the prices for 1910 do not vary materially from those of 1909; while the city officials anticipate about the same prices for 1911 as those which have prevailed during the last two years.

Automobiles within the Old and the New Provinces of Ontario regard the conditions as they relate to country and city in general, as being satisfactory, so far as the laws are concerned. Proprietors of automobiles pay a registration fee of $4 yearly. Chauffeurs pay a fee of $1 each. They are not required to undergo a technical examination. But the majority of those who drive for owners of private motor-cars have visited the States extensively and are up-to-date. They have neither union nor club. Their wage is about $60 per month.

The Ontario speed-limit in rural districts is 15 miles; while 10 miles obtains within the confines of cities. Search-lights are prohibited. Gasoline sells for 20 to 25 cents per gallon in small quantities and about 15 cents in bulk.

The customs duty on assembled automobiles brought into the Province is 35 per cent. When parts are imported into the Province, or the machine comes in disassembled, the duty is 15 per cent. The duty on rubber tires is 35 per cent.

The great majority of the motor-cars now in use in Ontario are American-made. Great Britain comes second; with a scattering of machines of Continental European make, and a very small percentage of cars built in Canada. In fact, there are but three of the latter—all of which contain American or European-made engines. The Canadian-built cars sell for $2,600 to $5,500 Motor-cars of other makes are sold at the standard prices—exclusive of duty—which obtain in the States and Continental Europe.

The Toronto city officials have adopted motor-cars for official use, generally speaking. The Municipal Government appropriated $7,800 for the purchase of a combination hose-wagon and chemical engine for use in the Fire Department and tenders have been advertised for.

The Street-Cleaning Department has two automobile flushers and two trolley-car flushers in commission, all of which have proven to be a great success after two years of tests. They were made in England. The two automobile flushers do the work of 16 horses. They cover about 21 miles of streets in a nine-hour day, which represents the work of four watering-carts. It costs approximately 78 1-2 cents per mile with the automobile flushers, as compared with $2 with the horse-drawn carts. Each motor-truck costs the city $5,200, delivered.

The interests of automobilists are looked after by the Ontario Motor League, whose headquarters is in Toronto. It has a membership of 2,600, and it is affiliated with the Royal Automobile Club of Great Britain, thus affording its members touring in Europe the privileges of that Club. The Ontario Motor League grew out of the Toronto Automobile Club, which was established about ten years ago. The League stands for the protection of its members against adverse legislation; the general betterment of their interests; and the encouragement of careful driving on the part of chauffeurs.

Of taxicabs there are less than fifty in Toronto. The tariff per passenger amounts to 28 cents per mile. The vehicles were made in England.

How the S. A. E. Worked at Dayton

Discussion of Papers and Committee Reports

In the issues of THE AUTOMOBILE *of June 15 and 22 there were published the papers and committee reports submitted for consideration at the Summer Meeting of the Society of Automobile Engineers at Dayton, June 15-17. All the papers and reports were discussed at length by the members assembled, and many additional points of interest were brought out. A portion of this discussion was printed in a previous issue; the remainder, slightly abridged, is given herewith.*

WHEN the issue of June 22 went to press the stenographer who recorded the proceedings of the Summer Meeting of the Society of Automobile Engineers, at Dayton, had not transcribed all his notes. As much thereof as was finished, however, was hurried East, and appeared in connection with the story of the meeting. The remainder, with the irrelevancies eliminated, follows, beginning with the discussion on the report of the Broaches Division:

PRESIDENT: The next matter before us is the question of broaches.

MR. DAVIS: The canvass was made primarily to reduce the number of broaches used and to bring before the society, as you all know, the question of what really was the desirable standard to adopt, and to consider the whole matter from the manufacturing as well as from the engineering standpoint.

In our recommendations, first, we come to the spline shaft, and in that form the committee considered the matter from two standpoints. When I was here the other day in the preliminary meeting they asked me to have sketched out something that would give a little idea. (Puts sketch on blackboard.) This shows the two methods of fitting: One here—the hole ground to fit the mill portion of the shaft. This one here with the shaft ground to fit the broach portion. That is a matter that is not new in discussion, and I think the consensus of opinion of the committee was to recommend this form (pointing to same) as lending itself readily to manufacturing conditions. Our position in the matter being this that if, in machining, care is taken in regard to the broaches produced, if they are ground accurately and the sides ground, and that a hole can be broached sufficiently accurate to use it as a working point from which all finished portions on the gear shall be taken, and that the clearance can very readily be controlled because of this grinding upon the side. On the other hand, with the mill portion here it brings in the question of grinding the hole practically to the pitch line. There is quite a variety of opinion among manufacturers in regard to the loss in manufacture due to distortion from hardening or other causes, and due to imperfections in grinding to the pitch line.

As far as I have been able to discover in talking to engineers, the percentage lies in favor of using the finished broach hole as a working point, with necessary hardening to maintain size and then grinding the outer diameter of the shaft for proper clearance. That takes care of the question of the broached shaft.

Following that we come to the question of sizes, and to bring this matter before the society we sketched up this form. (Puts the form, with pins, on the blackboard.) In talking with a number of manufacturers—those who were not only using square shafts on gears for all purposes—the committee recommend, as a general standard, using the ratio between the short diameter, which is the distance across the flat and the long diameter or the diameter of the stock from which the square is made. Took that ratio as .8, and the full lines here will show you just about the proportions. This is drawn ten to one, and it shows you the relative portion of the form that is left. These sizes, in running from sizes up to inch and half, by quarter inch; and to three inch; and by half-inch sizes above that. And there it is, a sliding fit under extremely heavy duty; then carry out to dotted line, making the ratio .73. These are shown in the dotted lines, which brings it to quite a sharp point.

The committee felt that for the average practice that the .8 ratio will give good results both for sliding fits and for force fits, whatever difference there is between sliding fit and the other being made on shape. This narrows it down to one set of broaches for both purposes. It also narrows down the sizes taken within this ratio. We found by a canvas which Mr. Clarkson made that there were in use to-day something like 75 to 100 different sizes, varying by 1/64 or 1/32, and this narrows the number down to fourteen, and gives us a range which we think will give us practical results. Of course, it doesn't shut any one out from using special broaches if they see fit. But in general practice, for future designs, we believe that the range can be covered, and covered effectively, both from a manufacturing and a theoretical engineering standpoint by the adoption of these standards. There are a few errors in the table shown on page 5, and I am submitting a typewritten list here, showing those corrections which were made in the report as it comes before you later.

There is one other point that comes in the spline shaft, and that is the question of using even or odd numbers. From the manufacturing standpoint we feel that the best results were obtained, due to calibration and other purposes, by the use of even numbers. The odd number of splines is a difficult proposition to adjust and to measure accurately. As far as I know, in discussing the proposition the main argument in favor of the odd number is that it goes in the direction of the three-point suspension, possibly giving a little more accuracy. But in proper methods of manufacture it would seem to us that there would be no difficulty in using the even number, and that the advantages in favor of the even number would offset any advantage that there might be in connection with the adoption of an odd number.

There is another question in regard to the relative value of the square as against the spline shaft. The tendency at the present time is, we believe, toward the spline shaft. Of course, there is, as we all know, a combination of forces tending to open up the square that there is not with the properly made spline shaft, and there are conditions of manufacture in regard to the stock to be used where different sizes of square are to be used, which render themselves more readily to the use of splines. Personally, my preference would be in favor of the spline shaft.

MR. VON ROTTWEILER: When we talked about the subject yesterday, in standardizing these broaches, it should be found out how many splines we really want. One man wants an even number; the next man wants an odd number, and there we run in so many different sizes of broaches again. I think we should come to a decision as to how many splines we should use. Mr. Davis has had quite an experience in that line.

MR. DAVIS: I think the feeling of the committee was that on light cars four splines would be ample, and that we would hold to even numbers; but that on heavy powers, up to say over 40 horsepower and above that, that the six would be preferable as giving a little more satisfactory result. That is, it would give a greater factor of safety. But, as Mr. Souther has said, that is a matter of engineering judgment and in design in the various cars, our idea being that if the broach manufacturer is prepared to furnish either the four or six to standard size, then the matter of exact determination of that for any one designer would hardly be up to the committee, but that the society would adopt either the even or odd number as standard and the gradation of sizes as recommended by the committee, and then it would be up to the engineer of the various cars to determine whether he would use the four or six or the different size squares.

The idea was that it would be an advantage both to the broach manufacturer and to the manufacturer of parts to know that he could go and secure from stock, and the broach manufacturer also that he could manufacture in larger quantities, that in tallying up on various jobs to reduce the number to the smallest possible list, and at the same time have it effective, so that each one would be in a position to carry the work forward at practically the same cost in manufacture.

MR. SWEET: I would like to offer a thought in connection with locating on the outside of the driving lever. If we should adopt that, that makes it unsafe from the result that comes from a fire. It is practically impossible to fire that portion in solid. Whereas, if we locate on the hole, it will make it possible to grind the holes. In other words, they will be able to grind on both essential surfaces—the holes and the shaft portion. It would seem to me that that would be the better way because it would not make it objectionable to the manufacturer. We practice that in locating the bottom of the space. It would seem to me that there is advantage in not locating on the end of the dividing lever, but on the shaft on the hole.

MR. DAVIS: In covering that point it is true that there are manufacturers at present time that bring both the shaft and the bottom of the gears and the gear from the pitch line. Our main point in connection with that is in the one case, locating by the outside shaft, while it is true that we cannot grind at that point, if you choose that as a working point for all operations, it does seem to us that the percentage of loss or percentage of variation would be as small as you would get from working from any other point. Looking at it from a nicety of manufacture, it is undoubtedly true that you cannot grind both points, and possibly in some instances get a little closer result. On the other hand—I think we all have the same experience, that in gears particularly they get out of shape; they look for an eccentric shape gear, and in grinding by pivot line you are not assured of covering that point. There is a process used by some manufacturers—take it in carbonized work—of carbonizing and then broaching the finished broach after the carbonizing before the final treatment. But that has its disadvantages. I had a report from one company who had tried out both processes, using the same materials in heat treating, and it worked out that they had from two to three per cent. less loss in their gears from working from the outside diameter of the shaft over the grinding from the pitch line, and it was primarily to bring out that discussion and find out what the experience of the engineer had been, and let them, if they will, instruct the committee as to what standard shall be adopted.

MR. FERGUSSON: We have tried both. We are at present using the outside diameter of the spline shaft and not grinding out the hole. We have adopted that and it gives some nice results. We thought we would try to alternate it and made some the other way, but the manufacturing end of our business claimed that it was too difficult a proposition for them to set up the gear by the pitch line and grind a true hole, and we couldn't find a great deal of difference in the results of the sets of gears that we made in each way, and the manufacturing end of the business decided that it was a good deal more expensive to grind the hole in the gear, and so we fell back on the old system in leaving the hole as it was and grinding the outside of the shaft.

MR. SWEET: Regarding the locating on the pitch line, we have had some experience along that line. About twelve years ago I spent three weeks at the Pope Manufacturing Company. Mr. Rice attempted to grind the box and holes of large bevel gears by locating on the pitch line, and the results were not very satisfactory. But when they began to locate at the bottom of the space, then the result is much better. We find that it is better to locate at the bottom of the space and then we don't enter into the straightening of the teeth. We go right to the bottom of the space, and the general result is much better.

MR. VINCENT: A thought occurs to me along that line: wouldn't it be possible to adopt a standard set of broaches that would be,—that would make it possible to use either practice,—in other words, the broaches to be large enough to give clearance where the hole is ground out and simply make the outside of the spline enough smaller for clearance, or where the manufacturer preferred to make the spline enough larger to grind. It is just a thought that might be worthy of discussion.

MR. DAVIS: I believe it would be possible to establish what has been recommended on the subject of broaches. Following the line of the suggestion of Mr. Vincent, I think it would be possible to adopt the standard as suggested by the committee and that that could be finished either way,

end it would be a question of results on shaft fittings, while your broaches would remain constant.

Mr. Sweet: It would seem to me wise to leave that point open. It would seem too bad to close the door upon the other scheme. I believe it will serve more of us if we had suggestions along both lines. In other words, don't close the door. For I think many of us will resort to what we need anyway, but we would like to follow the standard as well as possible.

Mr. Foljambe: I move the report of the committee be adopted. Seconded. Carried.

Discussing Magneto Standards

President: We have from two members in different parts of the room a suggestion that one of our committees get busy on the magneto standard; the base height of dowels and coupling distances from the gear; center from the drive and spark device will have to be considered. It seems to me this is a very good idea, and I believe we have men among our Standards Committee who can handle this matter. If not, the council will see to it that it is taken care of,—unless there is some objection. Of course, I know that there are some standards now, and it only remains to investigate them and put them in our book where they can be seen. I think no further action is necessary.

Mr. Slade: I would like to suggest while on question of standardization that some elements which will be elements of motor speed, whereby the spark advance can be eliminated will be a point that the committee can take up. There are not any magnetos on the market now which are applicable to motors having a very wide range of speed, without an automatic spark advance. I think that is one phase of the subject that the committee should consider.

Mr. Muskovics: The point is a very sore point with practically every manufacturer of magnetos;—the matter of couplings and base height is a very serious matter. I think that the suggestion that came from the other side of the house came from a magneto manufacturer that has over seventeen thousand models. And I know another one that has just about as many, and their troubles are very great. I think that there is nothing in the line of standards that would help much more than this one point.

Mr. Von Rottweiler: I think that the height of the magneto base is the most serious thing of all. Every magneto takes a different size. A man couldn't make any pattern where the arm would be interchangeable. If I have a four by four and a half motor that I sell in thousand lots, and a man says I want an arm handle on it, and that pattern is made with a fair amount of side play; and on the next order a man will want something different and I have to change my pattern.

Mr. Muskovics: The point that is most important is the distance from the drive outward. We have always got the German height. We all had to follow them. But it is the other distances. I think Mr. Whitman could make some remarks on that that would be interesting. He has got about 150 models.

Discussion on Sheet Metals Division

Mr. Skemp: It is absolutely impossible to recommend the adoption of any particular class of steel for any particular part of an automobile. About all we felt we could do was to put before the users of the sheet metal the various grades that were ordinarily produced, describing as briefly as possible the finishes that were usually supplied and indicating the results that might be expected from the use of those finishes.

We are confronted, of course, by the fact that each branch of the sheet metal industry uses its own particular gauge. Some use the United States Standard gauge, and others the Birmingham Wire Gauge. We don't think it was within our jurisdiction to recommend the adoption of any special gauge. Each of these gauges has its equivalents in thousandths of an inch, and we feel if specifications were written up in thousandths of an inch, and if the specifications when so written are made to conform as closely as possible to one of the gauges of the department or branch to which the specifications refer, it will be much more easy, of course, to obtain stock sizes.

I would like to say, in regard to the finish of sheet steel, that there is a mistaken impression in the minds of most users as to the results they secure by the use of pickled and higher cold rolled material. I would say that sometimes it is necessary for that material to be used. But whenever any process involves the heating of the material before it is pressed or formed, the necessity for the pickling and cold rolling is done away with and the expense of that treatment is absolutely useless expense.

The cheapest grade,—the blue annealed sheets—as far as the steel is concerned is the best. The finishing processes really add nothing to the value of the steel. They really detract from the steel and wherever it is possible to use the cheaper product,—the blue annealed product—without injuring the dies or stamps, that product will give the best results.

In regard to the question of uniformity of thickness: That is a matter that has been dealt with with great care. It is an absolute impossibility in the manufacture of hot and cold material to preserve a uniform thickness throughout the sheets. There is a constant changing in the contour of the rolls owing to expansions by heat,—from slight inequalities in the temperature of the steel. And it is necessary to allow for liberal tolerance in regard to these matters. Your committee has indicated what may be considered as reasonable variations in the thickness of hot rolled material.

President: I feel that this report is one that might well go into our data book as it stands. It is not done, and it will be a long time until it is done. But it is a start in the right direction and is extremely instructive and ought to be helpful to anyone contemplating the using of sheet metal or the ordering of it.

Mr. Hussey: I make a motion that it be adopted. Seconded. Carried.

The Springs Division Report Discussion

Mr. Bergmann: You all have copies of the report of the Springs Division, and you will notice on the last page that there is some discussion regarding the size recommended on center bolts, as well as the standard thread, which we suggest as ⅛-inch pipe, requested by the committee.

Mr. Holsman: I was looking over this paper this morning;—I may have gotten hold of the wrong paper, but as I remember I saw the A. L. A. M. Standard thread was specified for bolts. I don't just see where that is now. I would like to ask why A. L. A. M. Standard threads should be used for bolts and springs?

President: There was one suggestion made to the Standards Committee and adopted by the Standards Committee in relation to flexibility.

Mr. Landau: On the subject of springs, I would like to make a few remarks relative to nomenclature, especially "flexibility." The word "flexibility" is used by the sub-committee and its correctness applies to the semi-elliptic type of springs. The word "flexibility" is used abroad to-day as denoting the deflecting per 100 kilometers. But they also use the same word in a little different form. They place fifty pounds upon the quarter section and call the deflection the flexibility of the quarter portion. The advantage of stating flexibility in that method is very evident to one having to calculate it, because by adding the flexibility of half elliptic per 100 pounds to the flexibility of quarter elliptic per 50 pounds, you get the total flexibility of the three-quarter spring. I would suggest that the term flexibility be as stated in the report and add the flexibility of the quarter for the deflection of fifty pounds on the quarter portion.

In reference to nomenclature, there seems to be some inconsistencies in the definitions. First we have A, known as half elliptic. Under B, it says, "elliptic; consists of: top half, elliptic; bottom half, elliptic." It is evident from that that Spring B must be composed of two full elliptic springs. In other words, it is twice as many springs as is shown there.

In reference to C, called the scroll elliptic, I am inclined to believe if this was placed in our data books there might be some misconception because there is a type of spring that is used,—particularly abroad,—and will be in this country, known as the scroll, which is practically the same as that shown, except that the shackle of the scroll portions has the scroll portions independent.

In reference to F, the definition of the three-quarter elliptic, there are some inconsistencies at the bottom there where it says joined at both ends by bolts. From the sketch it is evident there are not two bolts. Therefore I would like to see the word "bolts" changed to "bolt."

In regard to G, we have a form of spring shown which is very largely used to-day in horse-drawn vehicles. But upon investigation—when I received this report—I might as well say that Mr. W. H. Son, who is on this committee, asked me to take care of some of this for him, and he gave me at my disposal quite a lot of information, regarding quite a lot of the springs that they have been supplying. There is only one manufacturer who supplied the type G for the automobile in the last seven years; if there are any more, I would like to know it, and I have never seen it used on an automobile except once. I would, therefore, suggest that type G is practically obsolete as far as the automobile is concerned, and I don't see that we need a definition here.

On the subject of springs shown in type H, known as the three-point suspension. It has long been known as a form of platform spring. It would be better to call it a three-quarter platform, because the term "platform" has been very common. Therefore, I suggest that we adopt the name of three-quarter platform for the so-called three-point suspension.

About that four-point suspension, I must state I have never seen it used in an automobile.

In connection with the recommendations on page 5 for ordering springs, there are several places I wish to call attention to. I might stop here for a moment and digress from the subject by saying that I think it would be advisable for the committee to add to this paper sketches indicating the dimensions to be followed in ordering, because I find that the men who are working in the spring plants cannot name certain parts without you show a sketch indicating what you mean on account of the variety of sketches.

Under A we have, "Give type of springs desired. Exercise great care to select types suited for purposes to which put." I would like to have the committee recommend the type for suitable purposes. In other words, how can we exercise care unless we know what type we are going to use. It seems that the committee should exercise care in recommending a type.

In B it says, "Specify material." There is no objection to that as long as the material is specified in a proper sort of way.

In C there is some misprint. It says, "Specify width of spring either by 000 or ¼ inch." I think the committee intends that to mean, specify width of spring leaves in inches. Or if it intends that to mean thickness, it should be inches or the standard gauge. Otherwise, C is inconsistent with itself.

The next subject which is really of importance, and is not quite so academic as some of the others I have mentioned, is the question of standard sizes and width of steel. The committee recommends inch and a quarter for pleasure cars. I don't know, but I would like to ask Mr. Tuthill if he considers inch and a quarter a standard size for a pleasure car. Inch and a quarter and inch and a half are not really standard size for pleasure cars. They are special sizes. I venture the opinion, and I rather think I am right, that our mill don't carry those in stock as regular sizes for an automobile. The three-inch size recommended in the same place is not really used in pleasure cars. It may be put down as commercial pleasure car size,—such as the large sight-seeing wagons.

In D,—"Number of leaves in gauge to be left to the spring maker." I don't know what that means,—unless the word "in" should be changed to "and."

Referring to E, it says, "Give offset, stating length on both ends on straight line between holes in brackets. This should be given on all half elliptics." I prefer there myself to show a sketch, because we don't know what the half length of a spring is; sometimes it is not a half length; that is, in the offset spring there are two halves, which are equal to a whole, but not halves in themselves.

In the three-quarter scroll, bottom half, the committee says, "Give distance on straight line from hole of front bracket rear spring to point on frame vertical to rear axle." I would like to know if the axle is going to be parallel to the floor. That seems to be inconsistent. I would recommend that the committee in this particular case shall be requested to make a diagrammatic sketch, indicating clearly what they mean. I venture to state if this paragraph is read carefully, almost every member in the room will give a different opinion.

Getting down to the latter part of it on the same page it says, "Give distance from spring seat to spring seat, or bracket holding upper quarter." That is not really what the committee means, I believe, and a sketch here would be very advisable. In the case of a three-quarter scroll the distance is usually given from the bottom,—the short space of the half elliptic. That is not stated by this definition. At least it wouldn't be considered so by a spring maker.

I would like to ask the committee what they mean,—"Do not give depth of scroll."

Commenting on some of the things that are mentioned here that are excellent,—for instance, "Give clearance under load with passengers, in front of two nearest striking points and position relative to rear axle,"—I do believe, in taking the entire report of the committee,—this one paragraph is really the most important, taken every which way. We have complaints in regard to springs, from this feature. It is not the spring makers' fault. It is the fault of the customer in not giving the clearance in front of the two nearest striking points. I imagine it has cost every spring maker a good many thousands of dollars a year to get this little information. If it is not stated, you are likely to have the spring maker make a very heavy spring, or he is likely to get it too light. But he can make them right, and make them cheaper, if you give him the right information in the first instance.

Next, we have, "Give center of load front relative to front axle" and "Give center of load rear relative to rear axle." Those two points there I want to say that I don't personally understand what they mean. I would like the committee to make it more definite.

It says, "State whether spring takes driving." I would suggest that they add "before breaking." Because the stress of the main leaf changes very rapidly. If it does take breaking, the number of clips applied to

the spring will vary if the breaking in must be taken on the spring.

"Give number of passengers," I think is very advisable.

There is one point that was discussed at the recent meeting of the Society here,—that is the truck situation. Everybody is interested in truck spring design. It says here, "On trucks give merchandise load." I would simply add at present that it is desirable for several reasons,—the truck designer would especially appreciate it, if you were going to supply cars to a certain concern and you know any of the service,—I would say give the merchandise load and also the nature of that load. If you are going to supply one hundred trucks, we could give you better springs if you can give the nature of that load. It doesn't cost any more to you to specify it, and you will get a better spring for less money. If you have got to carry flour, you will have to have a little different spring than to carry beer.

On the subject of flexibility, I have expressed myself already.

Next we come to the features to be left to the spring maker. It says, "Eye up or down, in or out." When I first returned to this country after having served my apprenticeship with spring makers abroad, and I came home and found expressed in and out. And frequently what was meant by "in" was "out." I would suggest that here is a very important point for the committee to indicate by sketch what they mean by eyes up and down, and in and out. While it is perfectly clear to the spring maker, it is not to the spring user. There are conditions where the designer will know much better which to use. Of course, he can leave it to the spring maker in certain cases, but there are cases in which he cannot leave it to him.

I don't know what the committee means by "spacing of leaves." But I suppose it is the pitch of leaves. In which case, it is commonly expressed in technical literature, as the pitch of the leaves, rather than the spacing of leaves. The committee has to "state whether shackles are under compression or tension and length of shackle used." I don't know whether it is essential to know whether the shackles are under compression or tension.

I am not prepared to express myself on the subject of bushings. I will say that with gas-hardened bolts, bronze is desirable, although the question of steel bushing,—I don't know.

In connection with eyes on pleasure car springs; for reasons that I cannot express briefly, I am sorry to state that I cannot agree with the committee on this subject at all. It is impossible to specify these on theoretical grounds and on practical grounds we have got to wrap two leaves around the eye, and the eye we have here is simply the common eye, and you will find that they have three springs wrapped round the eye. And there are good reasons for it. That is, the clearance upon the successive wrappings of leaves, which are even more important; many of the engineers say that the eye wrapped around the faces have no clearance. With one engineer he wouldn't allow us to separately open the eye a quarter of an inch to allow for the location, and it would be advisable for the committee to add a certain opening that must be kept, so the engineer will not insist on the spring maker giving him what is a close wrapper, which is a physical impossibility, because it doesn't work that way unless you introduce severe stress on the second bolt. I would, therefore, suggest that the idea of one leaf be left entirely out, or left to the spring maker.

In regard to the width of bar, the committee states that there are zero tolerance and plus tolerance. Zero tolerance means the size of the hole and the size of the bolt are absolutely the same.

Discussion on Uniform Gear Shift Position

President: The next matter is the report of the chairman of the Miscellaneous Committee.

Mr. Bergmann: We have several questions to take up. The first is the gear shift position. The matter of the gear shift has been referred to the members of the committee, and we have submitted sketches with the three- and four-speed arrangement. Naturally this is an interesting subject and I would like to hear from the members in regard to their choice.

President: It is considered possible by the Standards Committee to put in our data book several gear shift gates. This may do something toward keeping the engineers or draftsmen from designing new ones. I don't know that there are any more new ones, but possibly there are. There is no doubt that all cannot concentrate on one, but if they could concentrate on two or three, it is certainly something, and so this subject is before you from this point of view.

Mr. Ricker: I would like to repeat some of Mr. Camper's points that he brought up; they are, as shown here, that the high speed should always be at the back, and that it was advisable with this combination to have the emergency brake a pull lever. In that way, a man in a hurry to stop would not have the opportunity of grabbing hold of his speed lever instead of the brake, because the high speed lever would probably be at high speed, and the brake lever would be entirely isolated at the forepart of the quadrant.

The other point that he brought out was that with a four-speed gear box you invariably start on second speed, so that you really have the same conditions with four-speed gear box that you have with three-speed gear box.

Mr. Myers: I would like to call attention to the fact that there are two, of course, two styles of gear box using four gears; one in which the speeds are progressive, and the other in which the high gear is a gear up from the direct drive. In connection with that, the fact that on the last mentioned type of box, it is sometimes quite important to have the first gear and the reverse directly opposite one another, so that they can be readily used in traffic. The fourth gear is not as a rule used in traffic or in the city, but when you get out on a clear road it is, and I think that sketch should be included; and the fourth should be shown, there being three slides on the outside. I had a little experience with a gear box of that kind and where the reverse is put, as it is here, on the inside, it would be much more convenient to have No. 1 and the reverse in the same side; probably the fourth outside.

Mr. Moskovics: It would seem to those, who, like myself, want to go and borrow one of their friend's cars, that it is an embarrassment to find the low and high speed levers on different sides. It would seem that the committee could recommend a position of the low and high speed. It would make some advance in that line, and it would assist some of us that use so many different cars.

Mr. Ricker: In connection with putting the high speed on the outside, one point was brought up, and that is with inside levers on a fore-door gear it is most convenient to have the high gear as close to the outside as possible so as not to interfere with the comfort of the driver.

Mr. Coffin: It is just as easy for the designer to adopt one form of lay-out as to adopt a diversified lay-out, a different lay-out, because in nearly all sliding gear boxes, there are nearly always two or three slides used whether the high or low speed levers are put on the inside or the outside, according to the designer's selection. The idea in laying them out as they are laid out is that the form of the high and low are all the same in the three and four gear boxes. Almost invariably a four-speed box is stated on second gear, which on the four-speed box is exactly the same position as is first speed on the three-speed box. Therefore, the movements that the driver goes through in any of these designs are exactly the same. Had that been covered? The position of the high-speed lever at the rear places it in an out-of-the-way position at any time or almost invariably at the time that the emergency brake lever is to be reached in a hurry. In other words, there is no possibility, even for an amateur driver, of becoming confused and getting hold of the speed lever instead of the brake, and that happens very frequently. He will grab the gear shift lever and pull it back into some other speed and then get completely rattled; whereas if they only had one lever in front of them and that a brake lever there would be very much less chance to get into trouble.

Standardizing Steel Flywheels

Mr. Bergmann: Another subject that was referred to the Miscellaneous Division was that of screw standard. (Mr. Bergmann here read the proposed changes.)

President: That matter has been very carefully discussed by the Standards Committee and they believe that it should be acted upon at once. They further brought up the question of changing the name to the S. A. E. standard.

Mr. Coffin: There will be no objection, I believe, to the standards becoming known as S. A. E. Standards. The A. L. A. M., had turned over to this society all the work connected with such matters as this, and the name even of the organization once known as the A. L. A. M. has been dropped, and it would seem to me to be highly desirable to make these standards known as S. A. E. Standards. This would prevent any confusion which might arise in connection with any future work alone this line that we might want to do. I think that is all, from the committee's standpoint.

Mr. Foljambe: I move that the suggestion of the committee that these standards be called S. A. E. Standards be adopted. Seconded. Carried.

Mr. C. E. Davis: In connection with that, does that cover the necessary publicity in connection with people who are designating these in their catalogs?

President: The question now is as to the adoption of the modification and extension of sizes. A motion is in order. The A. L. A. M. dimensions are now in the data books. The changes are very slight, and they are not in the body of the thread, so that there will be no serious complication. It is a matter of head size, and it amounts to nothing from the engineers' standpoint.

Mr. Birdsall: I move the alterations and extensions be adopted. Seconded. Carried.

Discussion on Tolerance of Spark Plugs

Mr. Bergmann: The next question is the tolerance of spark plugs. The consensus of opinion seems to be from plus zero to minus .003. Is there any discussion on that?

Mr. Fergusson: I think I suggested that. I had a lot of trouble with different size spark plugs that they were making. And we wanted a pretty good fit, so I suggested .003 for the minus; and nothing over for the spark plug size. I don't think that is too small a tolerance to allow; .003 over size hole in the cylinder and .003 in the plug is .006, and it don't work well.

President: Is it the wish of the members that this refinement be adopted and the tolerance be plus zero, minus .003?

Mr. Birdsall: I move that be adopted. Seconded. Carried.

Mr. Bergmann: The next question is the standards of the rod and yoke ends as submitted by Billings & Spencer. This work has been gone over very thoroughly by the committee and has been accepted unanimously.

Mr. Birdsall: I would like to make a motion that on any of the former A. L. A. M. standards, when they are refined by this Society, that the name is changed to S. A. E. standards. Seconded. Carried.

President: The question is now on the adoption of the rod ends, that is, the recommendation of the rod ends and the subsequent printing in our data books.

Mr. H. I. Pope: I would like to make a motion that the rod ends be accepted and put in the note book in accordance with the recommendation of the committee. Seconded. Carried.

Mr. Bergmann: The committee wishes to announce that the title used in page 188 in the Transactions and known as Specification No. 26 for Oils, to change the name from Automobile Lubricating Oil, to Automobile Engine Lubricating Oil. I would like to have the members express their opinions on the vehicle taxation basis. The committee has asked me to announce that.

President: The question of automobile taxation came up last summer, and a number of us, to my personal knowledge, have been trying to find a formula that would fit all road users—horses as well as motors. The question of the old formula suggested itself—MV^2. And in attempting to apply that, it was found that V^2 was too big an element; that the figures went up out of sight. Then MV was tried, and MV seemed to fit pretty well, and then some attempt was made to find for what reason we should use the V, and quite a bit of correspondence was had with the railroads as to whether tracks wore out in proportion to speed or in proportion to load. It was stated by Mr. Buckwalter that it certainly was not speed and surely not the square of the speed;—that it was somewhere between V and V^2—probably near the V. The Michigan Central, I think it was, stated it was probably near the V. So I wish some of the members would set their wits to working to try and find a formula that we may safely hand to our law makers. Our law makers are coming to us pretty soon, and ask us how to tax all users of roads. With these thoughts in mind, the matter is open for discussion. Are there any thoughts?

Mr. Haynes: I think a certain amount of experimental data would have to be obtained first. The formulas would be of no value unless backed up by data that had been demonstrated by actual experiment, before it could be endorsed by the Society and before it would be a proper subject for consideration.

Standardization Steel Flywheels

Mr. Bergmann: Can I hear from the members regarding their views in connection with steel flywheels.

President: A very interesting matter has been broached by one of the large steel companies. They now say they are making some steel flywheels and welcome and ask our co-operation and ask that we give them sufficient data so that by some means they may propose a standard or get up a standard lot of steel flywheels which are forged. They get right down to nearly cast-iron price with their very rapid method of forging, which amounts to nothing short of spinning. They spin up the steel just as you spin up pottery.

Mr. Fergusson: We have used for two years now a forged steel fly-

wheel on our largest size engine. It has quite a large diameter. We are afraid of cast iron, and we have got a forged steel wheel there. And it works just as well, if not better. It gives about the same co-efficient as on the cast iron. In fact, it makes a much better wheel. The thing is in perfect balance. There are no porous places in the forged wheel. It is a balanced wheel and requires very little attention.

MR. HORNING: It has recently been our pleasure to go into the matter of steel flywheels with the steel company, rather than that they went into the question with us. And the first statement was that the cost of the wheel would be approximately what cast iron would be. We consented to have them make a standard wheel; it seemed that they had their specifications and standards at their place of manufacture. They submitted these, and we found that the cost of the wheel to us rough was more than the finished flywheel in cast iron. Now, I assume in submitting the figures that they gave us a wheel which they were producing in large quantities. And I had several calls from the representative, and he at last had to give up the job and admit that the steel flywheel in the rough would cost as much as the finished flywheel in cast iron.

It is only a question of safety in flywheels that we have found in our experience that the user looks at in flywheels. Where flywheels are cast with blades for producing the draught, the strings which fit on the relief are a constant source of danger. We have one experience with one flywheel which was being used at the time by a manufacturer to test out the engine. He was making a test on it, and it broke. An examination of the break showed that it was a casting string. In connection with the heat produced by the break and the heat due to centrifugal force, it was too much for the string and it separated. I recently heard of another case of a very well known car that it did the same thing. Therefore our experience with vane flywheels, as we call it, unless particular pains are paid to the relief casting strings, is that there is a great source of danger, there, but in the flywheel with the usual construction of solid web you can use a section down to 3-8 of an inch with safety.

MR. VINCENT: There are so many engineers right here assembled that are undoubtedly building motors, and if this one company wants to adopt a standard flywheel, and a certain motor has a compression of 65 or 70 pounds,—the next man has that same motor of the same bore and stroke with a different compression entirely. Now, in order to have a higher compression you need more flywheel energy and I think too many different sizes of flywheels would be needed to meet the demand, and I think a standard in that is out of the question because there are many different sizes of motors and so many different compressions in those motors that I think there would be so many different flywheels needed that it would be impossible to come down to a standard in flywheel design.

MR. COFFIN: I don't believe that it is possible to carry the idea of standards into a matter like a flywheel, which is so intimately interwoven with the vital parts of the construction. You have the gear box behind and the motor in front,—if you standardize the flywheel, I don't believe there will be very much limit to what you might not do. I think the things we should attempt to make standard are the things that might just as well be standard as otherwise. We have tried to avoid the standardization of any part which, or upon which the designer may legitimately exercise a reasonable ingenuity or ability. Such matters as rod ends and carbureter connections and so forth,—upon such matters as that I don't believe there is any engineer in the room who would care to spend very long in instructing some draftsman how they should be made. Therefore they may be incorporated in tables and that detail removed from our attention, to let us concentrate on things that are more important.

Paper on Aluminum Castings

PRESIDENT: One member is here who has come a long way to present this paper, Mr. Gillett.

MR. GILLETT: The paper has been printed and anybody that is particularly interested I hope will read it. The proposition that I want to bring out in this is that with the increasing number of aluminum castings the factories are requested to make they run up against very great difficulties, due to design and to patent constructions. The vital point of the whole matter,—the one that concerns not only the manufacture but the price and delivery—is in getting together with the factory at the right time. If the designing engineer would take these matters up with his factory and get their ideas on it and get their pattern makers in touch with the factory, it would aid a great deal.

I have a few samples here showing some of the defects due to faulty design, which perhaps I haven't time to pass around, but anyone that is interested can see them. They are labelled with the numbers corresponding to the reference in the paper. The whole proposition,—the best design of aluminum castings—is one of uniform section as near as possible Here are two samples. Those are parts of the same castings. This one is well designed; that is, there is no sudden great changing of section. This one you see has a crack in there. You have large sections here next to small sections. The small sections freeze first; the result is a crack. The losses on this proposition were far too much. There is no reason why they all should not have been made solid.

One other point is the design of the casting in such a manner to allow cold pouring. Cold pouring gives you fine crystals, well interlocked, and a strong nut, because the freezing takes place equally. If you have exceptionally thin portions in your casting, you have got to pour hot in order to fill your castings. The effect of hot pouring is shown by this bunch of test parts here, which corresponds to that shown on page 4, showing how the tensile strength falls off extremely rapidly with the increase in pouring temperature. This bunch of test bars shows a very good tensile strength, and at the hot end,—these were all poured from the same batch of metal,—at the hot end you get a very weak bottom,—very rough surface. If you can take up with the factory while your new designs are in your mind and in your draftsman's hands these points with those that handle the manufacturing of the material, I think you will serve your own best interest, and I think you must remember that these things we cannot change;—the design is up to the designer, and perhaps half of our factory troubles are traceable directly to the design and construction of the pattern.

Long Addendum Gears—Oversize Piston Standards

PRESIDENT: Mr. Weaver is here with a very good paper on Long Addendum Gears. The long addendum gear seems to be of greater value on one particular place, and that is the bevel driving gears, on the rear axle. There was quite a discussion the other night in regard to noise. This seems to get away from it to a certain extent. And it also provides a much stronger form of outlay. That is the main things to be said in favor of it. It does not require any special outlays, except possibly gauges for making it, most of the bevel gears being cut on Gleason machines.

There are one or two errors or corrections that might be made. On the second page down near the bottom, it says "For 20 degree pressure angle multiply the circular pitch by .5927 and .4037 respectively for the pinion and gear." It should be .4073. And on the next page, the sixth line from the top, it isn't clear. It reads B minus C, and it should read "line BC." There isn't any minus in there at all. And down a little further, there is a rather complicated formula given. It can be simplified greatly by multiplying the circular thickness by 28.648 and dividing by the radius. It is a matter of cancellation, and of course it is not printed in such a way that it would be very clear.

I have also added tables for the thickness for 4 1-2 degrees. For any one that wants to do a little experimental work it will merely furnish a little data to work from that has been valuable.

PRESIDENT: The next paper is by James N. Heald on "Oversize Standards for Pistons and Rings." This paper will not be read. What is the idea of the members present as to the possibility of doing something toward standardizing oversize pistons?

MR. COFFIN: Throughout the manufacturing season, there are always a certain percentage of cylinders faulty, through oversize dimensions. A cylinder is a pretty expensive portion of the car construction and naturally there is considerable regret in the manufacturing department with having a scrap pile of cylinders charge to their department. Our own practice is to save up cylinders which were oversize, and at the end of the season bring forth a series of motors, using these cylinders,—properly numbered, so that the service department can keep track of them,—and regrind them to a certain definite oversize. This saves a great deal of money.

PRESIDENT: Have you any thoughts as to taking action on that matter among the committee?

MR. COFFIN: It would seem very simple to adopt certain dimensions for oversize dimensions and for reboring of old cylinders for which it might be necessary to get larger pistons. We might go up by steps of .005 or hundredths of an inch or something of that sort.

PRESIDENT: At the bottom of page 8, in this paper it says: (Here the president read all of that part of the paper on pages 8 and 9, under the heading "What The Oversize Standards Should Be.") There is a suggestion of two oversize standards. Is it something that you would like to have the Standards Committee take up?

MR. FOLJAMBE: I move that the Standards Committee take up this matter as suggested in this paper. Seconded. Carried.

PRESIDENT: Mr. Clayden, do you know whether or not European manufacturers have made any attempt to carry oversize pistons?

MR. CLAYDEN: I don't know definitely that any of them are doing it at present. I know that they have in the past. It is rarely difficult to obtain an oversize piston.

Reducing the Number of Lock Washer Sizes

PRESIDENT: It is apparent from some of the statements made during the Standards Committee meeting that the various engineers have all taken a crack at lock washer designing. Now, it is a long jump from three or four hundred sizes of washers down to sixteen. It seems like a very radical measure perhaps. You will notice the typewritten list shows only sixteen sizes of lock washers, all of square sections, and that the square section is practically the short diameter of the U. S. nut and the long diameter of the A. L. A. M. nut. So it seems it has logic back of it. Is there anything that is objectionable in that? Is the washer too heavy, and is the proportion of 3/4 height to 1 width wise? The objection may be raised that the lock washer may be a little thick. Of course that will help its holding power, and that little is not very much. There is no question but what if sixteen sizes can be used for all purposes or up to inch and half bolts that the cost of lock washers will not increase—it may diminish after the trade becomes adjusted. There has been raised in committee the alternative for the 3/16 bolt, instead of 5/16 use 5/64; for one quarter, instead of 5/64 use 3/32. That is an increase of a sixty-fourth only in a few cases. Those small things seem to be the only question raised in committee.

MR HINKLEY: It seems to me that the suggestion about the smaller sizes is good. For instance, 3/16 or quarter-inch sizes are heavier than we will be able to use in certain places. It seems to me that the thickness is running out of keeping with the width. You take any parts designed where the property of appearance enters into it very strongly, it seems to me that we could get a slightly thinner washer that will serve the purpose better, due to the fact that a thinner washer will give a better locking property.

MR. SEYMOUR: In regard to that matter, one of the trunk lines in the country was using a washer 3/8 wide. They decided the washers did not have enough spring pressure. They did not want to spend more money for their washers and raised the question whether another shape wouldn't give the result. The shape of their washers was 3/8 x 1/4; in other words, the cross section which should be the same in a washer 5/16 in. square. They had some sections made which were 5/16 square. And they subjected the washers they had been using and the new type to a pressure test. They found the 3/8 x 1/4 gave a pressure of some 1800 pounds and the 5/16 gave a pressure of 2800 pounds; they have been making the square washers since 1885, and this washer in service will give just as good results as a washer whose height is one-half its width. In this list the outside diameter of the washer corresponds with the long diameter of the A. L. A. M. nut and practically corresponds to the short diameter of the U. S. standard nut. In other words, it comes as near a perfect appearance as you could get. The square gives the proper results as to resiliency. These sizes have all been used or ones the same form, so that we can stand behind each section and guarantee its efficiency. The same difference in shape has been made to accommodate the A. L. A. M. and the U. S. nuts.

MR. HART: I think that the Lock Washer Committee have cut the engineers down to too small variations. The engineers have designed over three hundred variations. I think I must give the automobile engineers credit for knowing the thickness of washers that they want in connection with their cars. Now, I appreciate the advantage of cutting down this list to sixteen if we possibly can. Take the 5/16 washer. I do not believe it can be used in all parts of the car. I do not believe that you can use it on brass or aluminum as well as you can cast iron. The locking power would be too great on the aluminum and brass; if that part had been taken off you would only destroy the lower backing, where the 5/16 x 3/8 could be used, very successfully with cast iron or steel. I therefore would favor giving the automobile engineers a greater variety to allow them a greater selection, so that they can choose a washer to fit the bolt, according as the washer is going to come in contact with either brass, aluminum or steel.

It seems that on 7/16 washer Mr. Seymour has remarked that there is only a slight variation of thickness from what the present automobile manufacturers are using to-day. I would like to say that for the past two years the automobile people have come together and have agreed to use and are using each others' washers more than they were four years ago. I can name thirty-five concerns to-day that practically adopted the 3/16 x 1/16, 1/8 x 3/32. I don't think it is necessary that we should hold to the square section, 3/8 x 3/8, 7/16. I would recommend 11/64 x 3/8, 1/2,—11/64 x 5/8, 9/16. I think a most satisfactory washer could be used there by using 7/32. Take the 11/16, 3/4 and 7/8, it really seems to me that, although very few of those three sizes are used to-day in connection with

the pleasure car, we hope that they will use more of them in connection with trucks. It seems to me that the Lock Washer Committee should give the automobile engineers, say, three variations of size on 1/16 washer and three variations on the quarter-inch; three variations on 5/16 and 3/8, keeping, of course, the standard lock washers as small as possible. You take the 5/16 washer; if they should prove of use, 1/8 x 3/32; this washer is almost too heavy to put in connection with any part where there is any brass. There is a great deal of manufacture, and it seems that on the last four sizes beginning with quarter-inch to 5/8, they have given such slight choice. Taking into consideration the lock washer manufacturers are carrying such tremendous variations of steel that it seems that these four sizes should be brought in, and the majority of automobile makers are using them to-day. That would be 5/32 x 1/8 washer. I would like to change that size on half inch—make that 11/64; change 5/16 to 11/32 x 3/8.

I think all the lock washer manufacturers to-day are practically manufacturing every size that the other has done. And it has been very difficult to get one engineer to change over. For instance, if you tried to get him to use 8/32, which you were furnishing to fifteen others, he absolutely refused to do it. They had designed a certain washer, and they considered it best for the place they were going to use it. There are many of them using two or three sizes on the 5/16, claiming that they have to on account of the metal they are using. I don't see but what the engineers would like to get all the locking power they can. They would like to use 5/16 washer, if they believed it would give greater locking power, than this 1/8 x 1/16, but the metal backing will not allow them to use it.

Mr. Seymour: That point against aluminum and against brass raises a point that has been argued by a good many of the automobile engineers, but I will state here that the largest users of lock washers use a 5/16 washer and use it against aluminum with no protection between the lock washer and the aluminum. Now, if you are going to look at securing good locking power against aluminum you have got to have a washer which is strong enough to take a bite on the nut. If you put a very thin steel washer between the nut lock and the aluminum it will not take as good a hold as the thicker washer, and the thick washer will not break off the aluminum. Now, the manufacturer to whom I referred is to-day using sections from a quarter and up larger in each case than the sections recommended by this committee. They have been using them for three years and the use has been very satisfactory. There was a good deal of question raised about three years ago regarding the use of thin washers. We tried them out ourselves and tried them out in comparison with other washers, and our experience was that they did not hold. We wanted to have an unprejudiced opinion on the matter, so we wrote to R. W. Hunt and Company in Chicago, asking them to make a test on washers. They used washers 3/8 x 1/16 and 3/16 square in their tests. They tested them on nuts and counter pins. I have a result of the test here before me. In the case of the washer 3/8 wide by 1/16 in height, they secured looseness after an average number of revolutions of 60,675; with the square washer it took 87,800; and in the installed nut and counter pin that created between fifty and eighty thousand vibrations, and the result showed that the effect upon the square washer was practically zero.

Mr. Hart: The practice of using a steel washer in connection with lock washers is quite old; but on this Lock Washer Committee we are trying to get away from sizes; you are introducing and asking the automobile manufacturer to use the proper weight washer that will dig into the head of the screw. I don't agree with Mr. Seymour that a washer made from 1/8 x 1/16 steel would not mar the head. I don't believe that all the engineers can get along with these washers. Mr. Seymour speaks of one concern using the size he recommends; the sizes I recommend are being used to-day by more than fifteen concerns and the largest machine makers of this country.

Mr. Birdsall: I agree with Mr. Hart that we need two thicknesses, although I recognize fully Mr. Seymour's remarks on the subject. It is my experience that the square washer is too strong on an aluminum backing. The only question is whether we can get a lighter washer that will bite into and also not ruin the aluminum backing after it is taken down three or four times in the repair shop. And I think there is enough of us here who have had experience with lock washers, so that we can determine now and incorporate in our suggestion to the committee the thickness of the lighter washer. My opinion is that they should be either two-thirds or three-fourths of the thickness of the square washer.

Mr. VonRottweiler: Now, here is a washer on this table, 5/32 inch thick; for instance, on 5/8 bolt,—if I wanted to use it against aluminum, I wouldn't care to use that; there would be too much pressure against the aluminum; that would be too much because you would tear the aluminum right out. You just dig a hole right in the aluminum, just by taking it off once.

Mr. Trask: We use a great many quarter twenty screws in a certain part of our car, under which we want a light washer, that is, about right for a thickness of not more than perhaps 5/32 of the thread; that is, threaded aluminum. Now, under those conditions it seems to me that 5/64 square is altogether too severe on threads of that length. Consequently, I think we ought certainly to have a lighter washer, perhaps two-thirds the width of the stock.

Mr. Birdsall: In getting at that 2/3 I think we had better hear from the gentlemen who dress the steel and see whether there is any commercial difficulties in the way of dividing these fractions by three; and whether it is possible to adapt the thickness to the practice of the steel makers.

Mr Bugie: It only means new dies. The three-fourth dimension would be much better because those sections are already in use. And of course the washer manufacturers have steel on hand for those sections, but they have no steel on hand for a section contemplating two-thirds.

Mr. Seymour: In the typewritten recommendations nothing is said about parallel face lock washer, and as there seems to be some confusion between the terms "plane" and "parallel" as used by the different manufacturers, I would recommend that the following paragraph be inserted: "That washers shall be of perfectly parallel faces and that bulging or mal-formed ends shall be avoided." The motion was seconded. Carried.

Concerning the Report of the Carbureter Division

Mr. Vincent: Mr. Sweet suggests that we stop off at 2 inches and not try to standardize the (carbureter) flanges above two inches because those don't interest very many of us. If we get into 2½ and 3-inch size, we have got to go into the four bolt construction, and there seems to be a good deal of difference of opinion in regard to the proper arrangement in the four bolt construction.

There was considerable discussion about the exact form of gasoline and water unions and the form of the throttle connection. The Standards Committee didn't exactly like the report of the committee on this arm, as they thought it was not quite definite enough, and it seems to be a general feeling that it would be impossible to standardize the throttle arm further than possibly the size of hole and the thickness of the boss at the end of this arm, which should be ¼ inch for size of hole and 9/32 thickness of boss, to correspond with A. L. A. M.

In going over a great many different carbureters some variation in size of pin was found. One manufacturer might have it ¼ inch. Another manufacturer will go 1/32 over that, or 1/32 under it. So that these flanges have been laid out sufficiently large to give reasonable gasket width, even on the largest opening, and of course the gasket will be a little larger on the smaller opening, but we have tried to strike a happy medium and not change anybody's flange very much. You will note that all the well-known carbureters follow this design closely. There were just enough differences to keep it from being interchangeable. The first thing to take up and see what we can settle on would be the matter of flanges. Is it the consensus of opinion that it would be well to stop off at two inches for the present and not try to standardize anything over two inches?

Mr. Sweet: The report is not quite complete, and we thought that we had better cover the sizes up to two inches, and then we can add information—after we can agree better on that point—above two inches. Mr. Vincent has said that the attempt has been made to change the standard flanges as little as possible. Having something to refer to until we get better information, we can refer to the Society's standards for two inches, and we will all know what we are talking about.

Mr. Briggs: It would be impossible for us to change at present to the sizes given there. We have written to several carbureter manufacturers, and they have all agreed to make them one standard. There are three or four manufacturers that have agreed to make it to standards such as we now use, and we wouldn't like to have this thing settled without a little further getting together of the manufacturers. We are all trying to standardize with the standards we now have. They make a very serious difference as regards the water jackets, and it would mean absolutely upsetting the entire factory, and also would make a considerable change with a number of customers who have their manifolds drilled to our standards.

President: Various attempts have been made to get the carbureter manufacturers interested in this problem. The response has not been very quick. Consequently the committee places before you something that seems right. The other aspect of the situation is this: that there will be no immediate revolution, but the changes made will be made in connection with new designs. That is, assuming that an engine is to be designed next month,—instead of taking something that exists or something new, as might be done, the engineer or draftsman will go to this little data book and take what would be known as a standard flange. Now, if that standard is a bad one, that is what we want to bring out at this time.

Mr. Briggs: Suppose the manufacturers of carbureters should all agree on a standard—would that suit the Society—if we would get together?

President: I would say if the gaskets were wide enough and of a suitable shape and pretty much like these, why, something might happen.

Mr. Briggs: The difference would be very slight,—it would be a thirty-second here or there; nothing radical. Nothing different in the design or in the general appearance of the flanges here.

President: The situation is this: If the carbureter people had come forward, they would have had a hand in it and the whole matter would have been adjusted at this time. Now, to get action, the committee places something before you. If it is bad, say so. If it is good, adopt it.

Mr. Briggs: The only statement that I had to make was that the difference is very slight, and I thought we ought to see the manufacturers before deciding on this and see whether they would rather use the standard that now exists among two or three of the manufacturers or wanted to have them changed over to the proposed standard. It wouldn't take much time.

President: We are confronted by exactly the same thing that happened in the tire matter. All have got to yield something. The differences of various carbureters have been in the hands of the committee for some time and were in the hands of the committee when these sizes shown on our blue print were adopted. Now, Mr. Behn tried to justify the differences and make the difficulties just as small as they could be; that is, not to punish any one company by radical changes, and that is what the blue print is supposed to represent.

Mr. Sweet: Each manufacturer wants to influence the standard towards that he is himself using. And if we leave it to the manufacturer we won't have uniformity. And the best results will be obtained in general if you follow out some uniform system that the committee has suggested.

President: In other words, you feel that these flanges are a fair solution of the problem?

Mr. Sweet: Yes. We find the carbureters wanting to cover an extra 1/16, and they rub the flange surface, and the flange is so light that the work will have to be very nicely done or the carbureter will leak. I believe that these standards are reasonable.

Mr. Vincent: I would like to explain that it is the committee's idea that these flanges should be put into the note book as soon as possible, and that it wouldn't affect current models, but when we design a new engine, we could then use the standards. For instance, if we were designing a new engine and wanted to use a freak flange, the chances are we could get the manufacturers to make the flanges for us; and why not lay out carbureter flanges along the same lines, instead of making new designs? If we could get carbureters with the same size flange, that is going to simplify the proposition, and as you run out of current models, the carbureter manufacturer will drift into the standard flange. So it don't look to me like it will place a hardship upon him.

Mr. Pope: I would like to make a motion that the report of the Carbureter Division of the Standards Committee be adopted as far as the sizes of flanges is concerned up to two inches. Seconded. Carried.

Mr. Vincent: The next point is the matter of gasoline and water connections.

President: That was very carefully discussed by the Standards Committee and the point brought out as to the length of the connection. Its advantages,—removing vibration, supporting the pipe, making repair easy. A motion would be in order to accept the report as far as these connections are concerned.

Mr. Birdsall: I move the report be accepted, in that particular. Seconded.

President: It is moved and seconded that the report be accepted as far as the gasoline and water connections.

Mr Aull: As I remember, at the Standards Committee meeting the other day, the suggestion was made that you standardize the pipe connections. It is not indicated here. It should indicate the size of pipe that can be used on a certain number carbureter. There ought to be something done.

Mr. Vincent: Personally, I would like to have seen the connections standardized for each size carbureter, but as there seems to be so much variance in the size of pipe used, it seems almost impossible to standardize the pipe connections at the present time. I must admit that I don't know just how to go at that,—to get down to a standard on it. Of course, it would be possible to tap out all carbureters large enough to take the largest pipe,—but whether or not that would be a good idea, I can't say.

Mr. Sweet: The fear along that line is on account of the various systems. One using the pressure system can get along with one kind of pipe, and one using another system wants a different size pipe. It would seem unwise to establish that for all. This report, as was suggested, is

quite incomplete. Whether we have accomplished enough to adopt certain portions of it is for you to decide. It was our opinion to submit the report as far as it had gone and add to it later.

PRESIDENT: Is there any danger in using this standard connection up to two inches?

MR. SWEET: I think not. I think it is very good up to the two-inch sizes. The reason we wanted to omit these larger sizes was we didn't feel just sure about them. We have been impressed with the fact that this supporting portion must be of quite definite size because if that is carelessly done and made 1/32 over size, it is entirely worthless. It has got to support the pipe very closely, and the difference there is to be recommended later. If you see fit to pass upon this, it is incomplete, and we feel that we could improve it very much before another meeting.

PRESIDENT: If the manufacturer takes hold of what we now have, we will be no worse off than we now are, because I will assume that he will make a reasonable fit. He tries to do it now, and he will try to do it with this standard before him, and that is a matter that can be refined. It is in the nature of a refinement rather than a radical change.

MR. VINCENT: The only other point is on the matter of throttle arm, and it is the opinion of your committee that it is almost impossible to standardize this throttle arm further than possibly indicating the size of the hole and the thickness of the boss. We believe that, after considering the matter in the light of the Standards Committee's suggestions that the hole should be ¼ inch, instead of 1/64 larger than the diameter of the pin or bolt, and that the thickness of the boss, 9/32, is O. K. That will conform to what has been the standard A. L. A. M. rod. I believe that all members of our committee would be glad to see the cut taken out and the dimensions given as a suggested standard for the throttle end; that is, quarter-inch hole and 9/32 thickness of boss.

MR. POPE: I make a motion that the eye of the lever be adopted as shown in the cut and stated by Mr. Vincent. Seconded. Carried.

MR. AULL: The motion was carried before the Standards Committee the other day to make the minimum length of lever two inches.

Views of a British Expert

The following extracts from the speech of Arthur Ludlow Clayden, editor of the *Automobile Engineer,* of England, proved to be one of the most interesting of those made at the banquet of the Society of Automobile Engineers at Dayton, Saturday, June 17. Among other things he said:

"One of the most interesting things I notice here is the difference between the automobiles of England and those of this country. One hears a great deal about the difference of the conditions in this country and in the United Kingdom. After all, it is a matter of road surface and variation of climate and temperature. It only means that your task is more difficult than the task we have at home. It really means that you have to guard against certain things we don't have to guard against.

"With respect to the engine, I see no reason why the small-bore long-stroke engine, which has proved in England undoubtedly superior to the older type, should not be found useful to you. I believe it is possible to make a long-stroke engine that is lighter. It runs at higher speed and you get less trouble in your transmission. And I should think that where roads are bad that would be even more advantageous than where roads are good.

"There are of course a great many engines in England in which the stroke-bore ratio is 1.5. There are a number of engines with stroke-bore ratios of 2. It is a little bit difficult to express a definite opinion. I am inclined to think that 2. is carrying it a little too far. But I think 1.75 will become quite common.

"Of course, the speed of these small engines is very high, too. I recall one that had a bore of 80 and a stroke of 120, and the number of revolutions was 3850 per minute. It is a little bit hard to believe. But in that case the valves were special and their diameter was considerably more than half the diameter of the cylinder.

"The great difficulty with these engines has been lubrication. Splash lubrication is entirely out of the question with an engine running at such high speed. The controlled splash with dippers on the back ends has proved useful for the comparative high-speed engine. But it is certain that the engine where the oil is flowed with force pressure is more durable. Of course, the Lanchester engines have always been so. They are supplied with oil where it reaches the engine at 30 pounds per square inch. The same applies to a number of others, and these engines last very much better than engines with splash lubrication.

"The great trouble with these engines has been the balance. That may be overcome in two ways. One is by making the reciprocal parts much lighter and also paying attention to rotation balance of flywheel and crank shaft. The other is by adding a number of cylinders and using small six-cylinders instead of large four-cylinders. That has signs of getting to be popular. That has difficulties owing to shaft whipping. That rotation balancing machine is doubtless going to help us put it right, and bearings between each crank throw are also essential. We have found that that balancing trouble is one of the most powerful influences against ball-bearing crank shafts. The ball-bearing crank shaft gives too little rigidity. It doesn't give you a rigid support, and the crank is going to roll around on the balls to any extent it likes; and there is very good reason to believe that it does so at high speed.

"The only other thing about engines is with reference to two-cycle engines. The two-cycle engine is coming to the front very much. I think it is an open question whether the engine in the future is going to be a two-cycle valveless engine or four-cycle engine. I believe in the possibility of the rotary valve over every other kind of engine. I think the rotary valve is the most mechanical idea. I won't say that I have seen any rotary valve engine which seemed to be obviously the right thing. I think we are going to get an ultimate type which will be a very good engine. Which of them it is of course time alone will show.

"The two-cycle engine has been made in very many forms. I believe that more two-cycle engines have been built in this country for body work than in all the rest of the world. The pump-filled two-cycle has also received a good deal of attention. And the Lamper engine was one of the few which was really feasible. It gives a very good gasoline economy. The N. E. C. engine which is oiled by the splash method is another engine that has appeared feasible. Then the Illinois engine,—now there are two cylinders connected with a common composition chamber, so that the fresh gases have got to pass through the whole system before they get to the outside. That is also very successful.

"The next point which we have been spending much time over is the quieting of transmission and axles. The manufacture of a perfectly quiet gear is always likely to be a matter of very great expense. If you are going to run spiral gears, they will have to be as accurate as a ball bearing or even more accurate. They will have to be ground perfectly and as far as I am aware there is no method for grinding small spiral gears which is anything like practical on account of the cost. Very much the same thing applies to bevel gears. Therefore I think the worm gear will come in entirely for the back axle, and I am not very sure but what the chain will not come into ordinary use for pleasure car work, as well as for truck work. There is one advantage of the chain box for truck work—we find in England that omnibus drivers and truck drivers are very careless men. They are likely to knock the transmission, but the worst thing you can do to a chain transmission is to break the chain. The cost of renewing the chain entirely—not considering the cost of a few links—is very small; and it is absolutely nothing as compared with the cost of putting in a new spiral gear which has been stripped. To insert a new spiral gear means taking the whole box to pieces. I know the London General Omnibus Company claim that they saved six thousand dollars a year on work alone.

"We have been discussing a good deal at home as to whether we are not building our frames too rigidly. You have only got to watch a car going over a rough road to see that a frame cannot remain rigid; and yet the majority of frames are made to be rigid. That produces body troubles, which I notice you are getting over here by the very extensive use of metal. I was very much interested in some of the bodies I have seen as being enormously strong. But I should think that they must be bad in places, after the bumping that they get on some of your country roads. Still more does this apply to trucks. There again I don't believe that anywhere in the world people are making proper bodies. I think the structures are too rigid. And I think the future will show us some frames or body designs with a certain amount of spring to allow the whole body to roll about on the axle freely.

"Another point on which I should like some information, and I am going to endeavor to get it before I go back, is as to why brakes in this country are almost invariably on the hubs of the rear wheels. The external brake has disadvantages; the big disadvantage is shown when it plugs up with mud, and I am sure that is the trouble that is found here. Of course, the internal brake can plug up, too, and if you run cars down to the axle, I should think they would get just as bad treatment as any external brake.

"What surprised me was the absence of transmission brake. I have always found that I could use a transmission brake under certain conditions of road surface when it wasn't safe to apply the brake to the hub. I believe the brake going through the gear has an influence upon the non-skidding properties. I know that is so upon greasy macadam. I should think that it would be so here. Of course I realize that a propeller shaft brake throws a great deal of stress upon the transmission, which it doesn't receive with the hub brake.

"The front wheel brakes I have tried myself, and I have talked to a great many other people who have tried them. Some of our manufacturers are building them as standards and some if requested. The front wheel brake has the advantage of pulling you straight. It has a great disadvantage if you apply it hard enough to lose all control over the steering. I was trying a system of brake which acted on all four wheels at once. I have tried it under extremely severe conditions of road surface, and I found it was practically impossible to create a skid with it. I also tried using the brake on one front wheel and one rear wheel, on opposite sides. That kept it from skidding, while the power was slightly less than when on all four. We are bound to see some developments of that nature.

"Another thing which interests me very much over here is the system upon which most of your works are conducted. That is, a system where you have a chief engineer with a staff acting as an advisory committee of construction.

"I believe that some of the best engineers we have got in England began their work as repairmen and gained their experience through others' failures. I know that some of the most successful designers began that way; men who were actually at the bench in a country repair shop, and there had opportunities of noticing the things that broke in cars of every variety. I believe, therefore, that every designer ought to have a stay in a repair shop. I think that a man who has been designing for some years would find that it would help him to go out and work in a garage for six months.

"I have heard a lot about the difference between the wood that is obtainable in the different parts of the world. There is no doubt but that the hickory wood that you get here will build a better wheel than any wood we have in England; but it won't build a wheel that is anywhere near as strong as a wire wheel. It won't build a wheel that is as durable as a wire wheel. It has been claimed that wire wheels are easier on tires. I have no evidence on that. I don't think it is likely to be a very big difference.

"The tire wear comparisons are extremely difficult to make because it is hard to get the same conditions twice. Even if you put one wheel on one side of the car and one on the other,—even then one tire is on one side of the road and one on the other, and it is always different, when the traffic is going in one direction. But I do believe that the wire wheel or the steel wheel is going to displace wood entirely in England.

"The only slide motor which I had some personal experience with is the Knight. I believe the Knight engine's method of getting free of the trouble of noise and of rapid opening is a very good way. There is a wonderful number of them running in England and running extremely well. The great advantage is once it is right it stays right until it is altogether wrong. There is no valve-grinding. Another thing is that it runs much better when it has got a fair layer of carbon deposited. I think it is a cool engine; when you have got a bit of a layer of carbon on the inside that retains the heat and gives you better working conditions. I think it is likely to be very many years before any one type of engine comes out on top,—even indeed if it ever does. One finds modifications of one kind or another. There must be a great deal of personal choice on the part of the designer. I don't think it can ever be otherwise."

PROPER PLACE TO STOP—When stopping for any cause the automobilist should bring the car over to one side of the road so that it will be out of the way of other traffic. In doing this a position should be taken up so that when the car is started again there will be no difficulty in getting under way. In bringing the car to the roadside the driver not only allows others the use of the road but protects himself from being run into or hindered while making repairs, etc. On the other hand, drivers who are otherwise considerate sometimes remain in or near the center of the road, if the stop is an involuntary one, and commence repairs, hindering other cars from passing and running the risk of being hit.

What Some Subscribers Want to Know

Convenient Position for Tools

Editor THE AUTOMOBILE:

[2,723]—I am desirous of having a body built according to my own design and would like to keep the running boards as clean as possible. I have made provision to carry the spare tire in a drawer under the rear seats, which eats up a good deal of space, the cushions being made deep, as suggested by you recently. Could you give me an idea of how to carry some tools that are likely to be wanted from time to time and do away with the unsightly tool-box that is found on the step of nearly every car? My experience of these things is that they are not waterproof, besides being unsightly, and the tools become covered with rust if left in the garage for any length of time without being used. JOHN.

New York City.

The method shown in Fig. 1 should overcome your difficulty, as by this means the tools are kept dry and out of the way, but instantly accessible when wanted. There is another advantage, viz.: out of sight is out of mind, and there is less likelihood of some one "borrowing" anything without permission.

Authentic Information as to Indianapolis Race Is Hard to Get

Editor THE AUTOMOBILE:

[2,724]—In the issue of THE AUTOMOBILE, June 1, in the list of prize winners in the Indianapolis race, you gave Dawson (Marmon) fifth place, while the detailed account of the race you gave the fifth place to De Palma (Simplex). Will you kindly enlighten me in the matter through your columns?

SHEPARD WILLIAMS.

Newton Highlands, Mass.

THE AUTOMOBILE published in the issue mentioned all the information of an authentic character that could be had in relation to this matter.

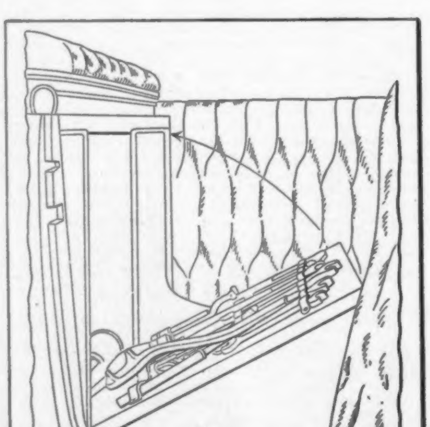


Fig. 1—Showing how the tools can be carried behind the front seats

Open the Exhaust Valve a Little Earlier

Editor THE AUTOMOBILE:

[2,725]—I have a four-cylinder motor with the following valve timing: Exhaust valve opens 45 degrees before lower center; exhaust valve closes 15 degrees after top center; inlet valve opens 20 degrees after top center; inlet valve closes 20 degrees after lower center. Will you be good enough to inform me if you could recommend any valve timing that would decrease the tendency for the motor to heat and at the same time not materially affect the power? E. EVANS.

St. Louis, Mo.

Quite a number of motors are so timed that the exhaust valve opens as much as 51 degrees early. You might emulate this good example. It is more than likely that your heating trouble is due either to an accumulation of carbon within the motor cylinders, or a scale formation on the exterior domes thereof; and it is also possible that the ignition system is too poor to properly ignite the mixture, in which event the flame travel will be retarded and overheating will be the normal expectation. Another way to lower the heating effect is to adjust the carbureter so that it will not deliver too much gasoline. This adjustment should be made when the motor is running slow, and the air adjustment should be accomplished when the motor is running fast.

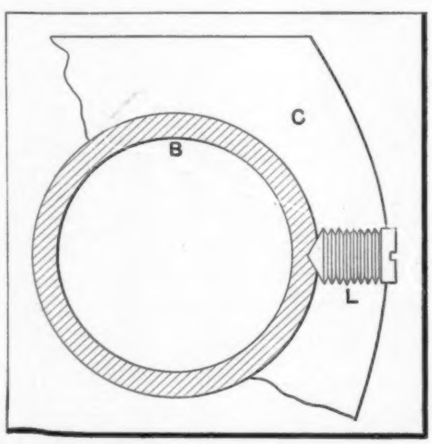


Fig. 2—Method of holding the camshaft bushings secure and preventing them from turning

Linseed Oil Will Prevent the Creaking Trouble

Editor THE AUTOMOBILE:

[2,726]—If the spokes of an artillery wheel creak when the car is started or the brakes applied, and tightening the hub bolts proves ineffectual, what should be done under the circumstances? It seems to be due to the spokes drying out and the application of linseed oil has been suggested. Only the rear wheels, which are subjected to the alternate driving and braking stresses, are thus affected, but the braking strains are unusually severe, as the brakedrums are not bolted to the spokes.

MURRY FAHNESTOCK.

Allegheny, Pa.

Take the flange off the wheel and apply linseed oil with a brush, taking enough time to make sure that the oil will soak in, then put the hub flange back and fetch up tight on the holding bolts.

The Editor invites owners and drivers of automobiles who are subscribers to THE AUTOMOBILE to communicate their automobile troubles, stating them briefly, on one side of the paper only, giving as clear a diagnosis as possible in each case, and a sketch, even though it may be rough, for the purpose of aiding the Editor to understand the nature of the difficulty. Each letter will be answered in these columns in the order of its receipt. The name and address of the subscriber must be given, as evidence of good faith.

How to Stop Camshaft Bushings from Turning

Editor THE AUTOMOBILE:

[2,727]—Would you kindly tell me, through your Letters column, how I can prevent the bushing of the camshaft of my motor from turning with the shaft. The bushing is made of phosphor bronze and the crankcase of aluminum.

Philadelphia. F. W. MARTIN.

The method shown in Fig. 2 will stop the bush from revolving; but in case the bush has increased the size of the hole it might be as well to have a new bush turned up. The crankcase C in which the bush B is housed should be drilled and tapped to take a small set screw L.

Address the Maker, Who Will Apply the Remedy

Editor THE AUTOMOBILE:

[2,728]—Being a constant and interested reader of THE AUTOMOBILE I take the liberty of asking you for a remedy for my Packard car. I have driven a Packard "30" for 15,000 miles and then had it overhauled in the agent's repair shop. Since then I have had trouble with the water; in driving my car over a mountain road on second speed it will boil. It never did this before it was overhauled. The circulation seems to be good and the radiator is clean.

What Other Subscribers Have to Say

The Editor invites owners and drivers of automobiles who are subscribers to THE AUTOMOBILE to communicate their personal experiences for publication in these columns for the worthy purpose of aiding brother automobilists who may be in need of just the information that this process will afford. Communications should be brief, on one side of the paper only, and clearly put, including a rough sketch when it is possible to do so, and the name and address of the writer should be given as evidence of good faith.

It has plenty of power and runs very free. A remedy for this will be very much appreciated. DRIVER.

San Francisco, Cal.

Interest Centers in the Motor Scavenging Problem

Editor THE AUTOMOBILE:

[2,729]—As a constant reader of THE AUTOMOBILE I have become very much interested in a means you mention for a more complete scavenging of a motor in your issue of May 18 on page 1142. I take the liberty of asking you where I can receive more information or reports of tests on the subject or if you know of some motors on which this scheme is used.

A. G. ROSENTRETER.

Boonton, N. J.

We have no information relating to the use of a device as referred to on page 1142 of THE AUTOMOBILE of May 18, as shown in Fig. 43. Isolated uses of a device more or less of this character would seem to indicate that it is an efficacious device.

How to Find Critical Speed

Editor THE AUTOMOBILE:

[2,730]—I was interested in a reply to a letter that appeared recently in your paper with reference to cars overturning, and on reading some literature on the subject I came across the words "critical speed." Could you tell me how to determine the critical speed? J. W. T.

Shenandoah, Pa.

First find the center of gravity of the car fully loaded and let this be represented by S as seen in Fig. 3. AB represents the wheel track and the line MS perpendicular to AB. Then, as the wheel A is just about to lift off the ground there can be no pressure there, and hence if the moments are taken of all the forces about B the sum of the moments must be zero. That is, $F \times SM - W \times MB = 0$.

If W = the weight of the vehicle,

V = the velocity in feet per second,

R = the minimum radius of curve through which the steering wheels will turn the vehicle, in feet,

$g = 32.2$,

F = the centrifugal force acting at S due to the turning action of the vehicle,

Then

$$F = \frac{WV^2}{gR}$$

$$\therefore \frac{WV^2}{gR} \times SM = MB$$

Canceling the common factor W, the equation becomes

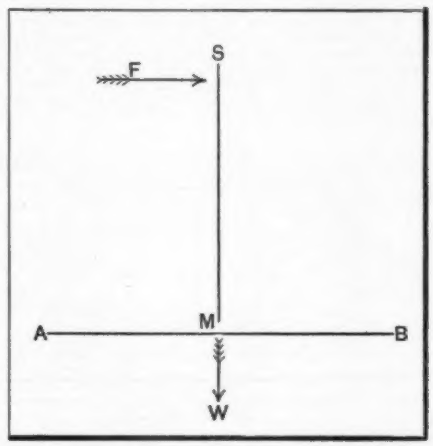


Fig. 3—Diagram used in determining critical speed

$$\frac{V^2}{gR} \times SM = MB.$$

$$\therefore V^2 = gR \times \frac{MB}{SM}$$

$$V = gR \times \frac{MB}{SM}$$

Simple Ignition Wire Attachment

Editor THE AUTOMOBILE:

[2,731]—I have been troubled with the ignition wires of my new car. They are all loose, and apart from making the motor look untidy they rest against the hot cylinders. I suppose the heat will have a bad effect on the rubber. Could you suggest a simple method of holding them together? TROUBLE.

Mullica Hill, N. J.

Take a piece of fiber and drill four holes in it for the wires to pass through, so that they will be a snug fit in the manner indicated in Fig. 4; then, with a bolt and nut and a piece of sheet metal, a clamp can be made to hold the bracket on to the intake manifold.

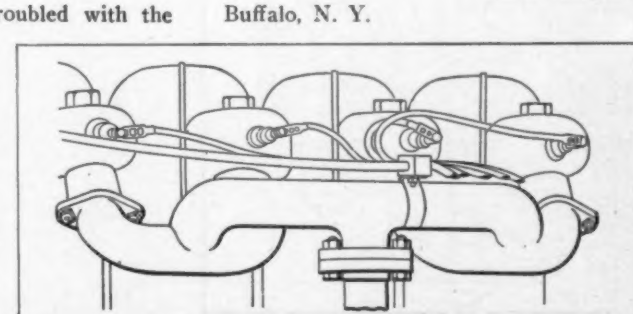


Fig. 4—How the loose ignition wires can be kept from rubbing against the cylinders

The Left Hand Should Be Used in Cranking a Motor

Editor THE AUTOMOBILE:

[2,732]—I saw in your paper some time ago an article on cranking a motor. I do not agree with you that the right hand should be used, as there is great danger of striking the wrist should the motor backfire. There is a tendency to throw the hand into the path of the crank. The proper way is to use the left hand, then a backfire will do no harm, as the hand is thrown away from the path of the crank. I have tried both ways and only yesterday I had a backfire and carelessly used my right hand and got hurt some. I consider it very dangerous to crank with the right hand. W. W. TREVOR.

Lockport, N. Y.

We do not call to mind having recommended right-hand cranking, nor would we consider doing so excepting in individual cases when the left hand is out of training.

E-M-F Gear Ratio

Editor THE AUTOMOBILE:

[2,733]—Will you kindly inform me, through your columns, what the different gear ratios are on the E-M-F "30"?

Johnstown, Pa. W. G. M.

The ratios are as follows:

High gear—3¼ : 1.

Second gear—6¼ : 1.

Low gear—11 : 1.

Reverse—6¾ : 1.

Get the Maker to Support Suitable Equipment

Editor THE AUTOMOBILE:

[2,734]—We have a four-ton Knox truck which we would like to limit to 12 to 15 miles per hour. Can you give us the name of a manufacturer of a governor which we can attach to same?

E. P. LUTZE.

Buffalo, N. Y.

Meeting Recurring Troubles

Presenting a Series of the Most Probable Cases

A series of correlated short stories, accompanied by diagrams and characteristic illustrations, including the nature of the troubles that are most likely to happen to automobiles, discussing their causes and effects, all for the purpose of arriving at a remedy. It is the aim, for the most part, to show how these troubles may be permanently remedied, and as a secondary enterprise it is indicated how the automobilist can make a temporary repair, thereby enabling him to defer the making of a permanent repair until a convenient time arrives.

Splash Lubrication of the Kissel Kar—The Kissel Kar four and six-cylinder motors are lubricated by the splash system. The oil tank is located in the base casting of the motor and forms the lower half of this casting. The oil reservoir is filled through a large filler opening in the forward left-hand side of the crankcase, which is marked in large letters: OIL. The filler opening is opened by means of a hinged cover which can be lifted and swung back.

The oil is drawn from the engine base by means of a rotary gear pump, driven off the cam shaft. The pump forces the oil into the splash troughs located in the upper base casting, on a sort of tray above the reservoir. There is a splash trough below each cylinder.

After having filled each of the splash troughs the oil is allowed to flow into a drain pipe, which runs the entire length of the crankcase. This drain tube is punctured by a long slot at each trough through which the oil enters the tube and drains back to the rear of the engine and down into the reservoir. There is a lever on the forward left-hand crankcase supporting arm, which may be raised or lowered, thereby turning the tube which contains the slots and respectively raising or lowering the point at which the oil may flow into the tube. The level of the oil in the crankcase at any time may be determined by means of a level gauge glass on the side of the motor.

As has been seen, the crankcase is sub-divided into an upper and lower half. The upper half has a trough below each connecting rod throw, into which the connecting rods dip, churning the oil therein into a flying spray or vapor.

The excess oil drains off the cylinder walls and flows back into the troughs, and in like manner drains off all the other bearings back into the same. After overflowing the oil will be drawn through the pump and be used over again. Before entering the pump the oil passes through a screen in the base of the motor.

This screen and the pump itself should be often removed and cleaned. The brass inspection plugs on the left-hand side of the crankcase should also be removed from time to time, to see that the oil openings in the supply pipe from the pump to the splash troughs are not obstructed in any way, as this would allow a greater supply of oil to get into one cylinder than another.

The timing gears are oiled by the connecting rod splash by means of an oil pipe which leads from the crankcase into the timing gear case. Other bearings all over the car are lubricated by means of oil holes or grease cups, as the case may be; while the transmission and differentials are packed in oil and grease.

Lubrication in Amplex Valveless Cars—The Amplex Model H. 30-50 horsepower car is lubricated by the force feed system. The crankcase is divided into three horizontal sections. The lowest section of the three is an oil well and this taken in conjunction with the oil in the force feed box carries the oil supply.

The force feed oiler is of the Hancock type. It is driven by gears from the crankshaft. The oiler is located on the exhaust side of the motor and takes up about half the length of the engine. It is boxlike in form and rests on a broad flange which projects from both sides of the crankcase for the entire length of the motor. The reservoir is cast integral with the crankcase.

Near the front end of the mechanical oiler box the filler hole is located. A spring cover can be lifted up on a hinge when filling the oiler, exposing the opening which contains a gauze screen through which the oil is poured.

A pump sends the oil from the reservoir through a sight feed on the dash, back to the mechanical oiler, then through a separate lead to each cylinder and main bearing as well as to the timing gears. There is one lead to each of the four cylinders, to the five main bearings, and to the timing gears.

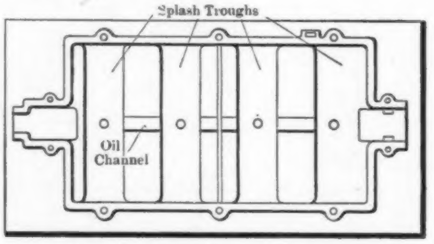


Fig. 2—Looking down into the oil reservoir as it is used on Kissel Kars

The flow through each of the leads may be made to be a certain proportion of the total flow, which is governed entirely by the speed of the engine, since the oiler is driven off the crankshaft. The relative speed of the whole oiler to the revolutions per minute of the engine is determined by the gears, but the amount of oil delivered depends on the stroke of the oil pump. This can be governed directly from the dash by means of a lever. This lever projects from the top of the oil box at about the center and is drilled at the top to allow a rod to be attached so that it may be operated from the dash.

Each oil lead has a sight feed on the top of the oiler box. A main sight feed located on the dash shows whether the whole system is working properly or not.

The oil drains into the bottom of the oil pan in the lowest part of the crankcase and will gather there in a quantity if too much oil is supplied to the main bearings and cylinders. In a case like this blue smoke will issue from the exhaust pipe and the lever on the dash may be used to diminish the supply of oil given to the motor.

There are drain pipes located in the bottom of the crankcase through which the oil may be allowed to flow out.

There are compression grease cups on the water pump bearings, steering knuckle bearings and all over the car at the revolving or oscillating bearings. The transmission and differentials run in oil while the universal joints are packed in grease.

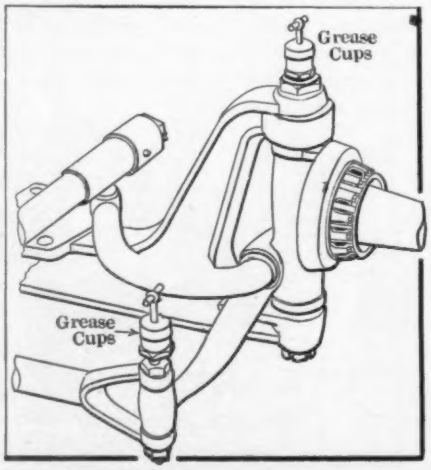


Fig. 1—Illustrating the manner of oiling steering knuckle on Amplex automobiles

Force-Feed Oiler Used on Stoddard-Daytons—The Stoddard-Dayton model 11-K four-cylinder car is lubricated by the force-feed system. The crankcase forms the oil supply tank and carries about two and one-half gallons.

A gear-driven oil pump which is actuated by the camshaft takes the oil from the base and pumps it into a manifold which serves as a distributor. The leads are supplied from this distributor and run directly to the crankshaft and camshaft bearings.

After lubricating the various bearings, the oil drains back into the bottom of the crankcase, which is covered with a baffle plate to prevent the oil from splashing into the cylinder in case the connecting rods should dip into it. The force-feed system is designed to completely and sufficiently lubricate the whole engine. On the rear right-hand crankcase supporting arm there is an oil level gauge glass. The oil in the reservoir should never be allowed to fall so low that it is not visible in the level glass.

When starting on a trip the oil level in the crankcase should be examined and if a sufficient height is not indicated on the level gauge, the reservoir should be filled. This is done by means of a filler pipe located between the two central cylinders.

The amount of oil supplied can be governed by means of a regulating nut on the side of the crankcase. To increase the supply of oil sent to the distributor the lock nut should be loosened and the regulating nut screwed down a turn or two, the lock nut is then tightened up again. To decrease the supply the process is naturally directly opposite to that of increasing it.

On the dashboard there is a pressure gauge which indicates the pressure on the pump. This pressure for ordinary country work should be about two pounds. For city use, however, the pressure need not be as high as this.

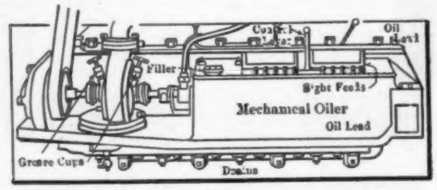


Fig. 3—The mechanical oiler of the Amplex and indication of oil distribution

As the oil by this system is used over and over again it is evident that an adequate straining system must be employed, so a strainer is placed so that the oil passes through it before entering the pump and another which strains the oil before it returns to the reservoir.

Oiling Apparatus in Use for Colby Cars—The Colby "40" is lubricated by both the splash and force feed systems. The lower half of the crankcase is divided by means of a horizontal partition into two parts; the lower part forming the oil reservoir and supply tank for the motor. The horizontal partition or tray is shaped so as to have a depression forming a small well beneath each cylinder. These walls are the splash troughs.

The oil in the splash troughs is constantly added to by that which escapes from the force feed system through the crankshaft bearings. As the oil is supplied to the splash troughs faster than it is used, there will always be an overflow over the walls of these troughs. This overflow finds its way back into the oil reservoir by means of overflow holes.

The force feed system is entirely separate from the splash system just described except that the oil for the splash is replenished by the oil flowing off the bearings supplied by the force feed system. The latter is operated by a gear pump driven off the camshaft by worm gears. It is located within the crankcase, which has a recess in both of its halves to accommodate the pump, pump shaft and gear. The pump may be removed from the pump chamber through an opening in the bottom of the crankcase.

The pump and gearing are located at the rear end of the crankcase on the left-hand (exhaust) side of the motor. This pump delivers oil to the main bearings under a pressure of about four pounds. After lubricating these bearings the oil is carried by centrifugal force through ducts in the crankshaft, into the connecting rod bearings. Then the oil will be thrown off the cranks and connecting rods into the cylinder or work its way up to the wrist pin.

The excess oil drains back to the oil troughs, which are constantly kept overflowing; the overflow draining back to the pump recess, where it passes through a strainer. The capacity of the oil reservoir is two and one-half gallons.

The transmission is packed in non-fluid oil as are also the differentials and the universal joint between the clutch and transmission. The other bearings are equipped with grease cups.

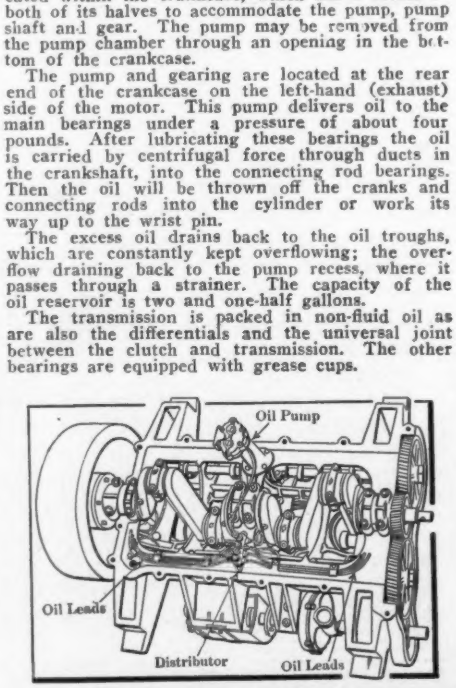


Fig. 4—Looking into the crankcase of the Stoddard-Dayton from below, showing oil leads

Lubrication of the Moon "30"—The Moon car is lubricated by the splash system. The oil supply is carried in the crankcase, which is so divided as to provide an oil reservoir in the bottom, as well as to carry a set of splash troughs. The splash troughs are carried on a horizontal partition which is cast directly in the base of the crankcase, being an integral part of the same.

The capacity of the reservoir or oil tank is about two gallons. It may be filled by either of two methods; that is through the breather tube in which there is a strainer or by means of the pump cover plate on the left-hand side of the motor.

The oil is drawn from the reservoir by means of a plunger pump, which is driven off the camshaft by spiral gears, and takes the oil from the reservoir in the bottom of the crankcase and sends it through the sight feed on the dash. The oil then flows back into the crankcase and supplies the splash chambers with oil.

The troughs are of such a depth that an adequate amount of oil will be held in them to

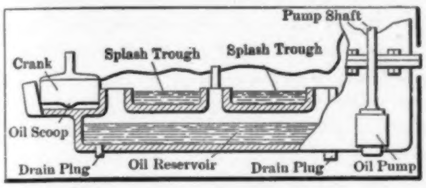


Fig. 5—Vertical section through Colby crankcase, showing location of troughs and pump

permit the bottom of the connecting rods to splash into the oil at any normal inclination of the car. When the oil overflows the trough wall it will drain back into the reservoir in the base. There are two large overflow stand pipes of elliptical shape. The purpose of making these overflow holes large is to allow the oil to drain from the splash troughs into the base as quickly as possible in case of an oversupply getting into the crankcase.

Between the two central splash troughs there is a solid wall of metal which is of the same height as the other trough walls. It does not form the enclosing wall of the overflow pipes as the other divisions between the trough do, but is pierced by two holes which form a communication between the two central troughs.

The oil is picked up by the copper scoops on the bottom of the connecting rods and thrown in the form of a fine spray up into the cylinders and the several bearings.

The train of gears which drives the camshaft on one side of the engine and the pump and magneto shaft on the other, are lubricated by the oil which they pick up from the trough which is in the bottom of the gearcase. This trough or oil well catches a supply of oil from the splash of the connecting rods. The gears dip into the oil and pick it up, thus carrying it to the top of the gearcase and into the bearings located in the case.

On the right-hand side of the oil reservoir there is a pet-cock at the correct level at which the oil must be kept. There is a large drain plug under the rear end of the base through which the oil may be drained completely out of the crankcase whenever the same is being cleaned.

The transmission and differentials are packed in grease, while the other bearings all over the car are taken care of by means of compression grease cups or oil holes, as the case may be.

Self-contained Fiat Oiling System—The Fiat car is lubricated by an entirely self-enclosed force-feed system. The lower half of the crankcase which carries the oil is formed so that the rear or flywheel end of the reservoir is the deepest part of the casting. There the suction pipe from the tank to the pump enters the casting.

There is a large drain plug in the base of the oil reservoir just below the point at which the suction pipe draws its supply from the oil in the tank.

The level of the oil in the crankcase is determined by removing the inspection cover provided for this purpose on the bottom half of the base chamber. The proper level to keep the oil is about one inch below the cover.

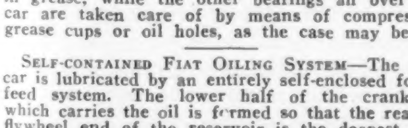


Fig. 6—The oil reservoir of the Moon car is formed by the base-chamber of the motor

A rotary gear oil pump, driven off the camshaft, lifts the oil from the reservoir through the suction pipe and forces it through a lead to the main bearings, then through the crank hollow shaft to the connecting rods, whence the oil is thrown up into the cylinders by centrifugal force, thus filling the crankcase with an oil vapor which is sufficient to lubricate the cylinders under ordinary circumstances. When running at higher speeds, however, the oil supply to the cylinder walls may be increased by pressing a button located on the dash. This button controls a valve which admits oil to a lead to the cylinders directly from the pump.

A pressure gauge shows the pressure on the oil pump. When the motor is running at normal speed the gauge should show a pressure of somewhere in the neighborhood of two or three pounds. When the pressure runs up beyond this point oil should be admitted to the cylinders.

When starting the motor after it has not been in use for a long time, it will often be found that the oil pump will not perform its functions properly. To aid the pump to draw properly in a case of this kind, a priming cock is placed on top of the oil pump, through which a little oil may be poured.

The gear box is kept filled to the level of the top of the gear shafts with medium grease. An examination of this bearing is advisable every two or three weeks.

Oiling System of Packard Cars—The Packard 1912 cars are lubricated by means of the splash system. The connecting rods dip into the oil, which is held at the proper level in a series of splash troughs in the crankcase of the motor. The splash of the rapidly revolving connecting rods into these pools of oil generates an oil mist which entirely fills the crankcase and lubricates all moving parts located within the crankcase.

The oil supply is carried in a tank which is entirely separate from the crankcase and is located on the left-hand side of the motor. The tank is made of copper and cylindrical in form. The copper construction of this tank and its location between the two middle cylinders, ensure a warm temperature for the oil while the motor is running.

The tank is filled through a filler opening in the

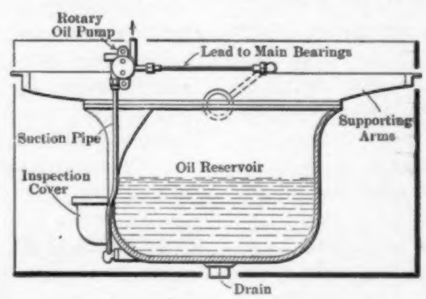


Fig. 7—Lubricating system of the Fiat, showing oil reservoir and oil suction pipe

top in which there is a wire gauze strainer which removes any foreign matter which happens to be in the coil. The two breather pipes from the front and rear crankcase compartments pass vertically through the oil tank. The oil flows from the oil tank through a pipe that leads out of the bottom and in which there is a three-way cock, which if turned towards the front of the motor completely shuts off the oil from the tank. Turned so that the handle is pointed transversely across the motor, the oil will drain off the tank; while when turned towards the rear of the motor the oil is fed to the pump.

The oil pump is located on the left-hand side of the crankcase at about the center of the engine in a longitudinal direction. It is on the outside of the crankcase directly below the oil tank. When the cock is turned to the rear of the engine and the motor is running, the pump will take the oil from the feed pipe and force it to the two sight feeds, located on the dash. The oil then drops through the sight feeds and flows through one lead to the rear crankcase compartment and through the other to the forward one. The pump is driven by means of a worm gear off the exhaust camshaft, and has two adjustable plungers, one for each of the two leads just described.

The oil carried in the copper tank is in reality the reserve supply of oil. That is, its purpose is to replenish the supply in the crankcase as it is burned up. Before starting the oil should always be put first into the crankcase so that the level therein is sufficient for the splash. To determine this level there are two pet cocks on the left-hand side of the bottom of the crankcase

The stroke of each pump plunger is independently adjustable. To increase the flow of oil in either lead, the adjusting screw and check nut should be turned downward for the plunger which governs the supply to that lead.

About every 1000 miles the old oil should be drained out by removing the drain plug in the bottom of each compartment in the crankcase. The crankcase should then be flushed out with kerosene, and, after this has been cleaned out, refilled with new oil.

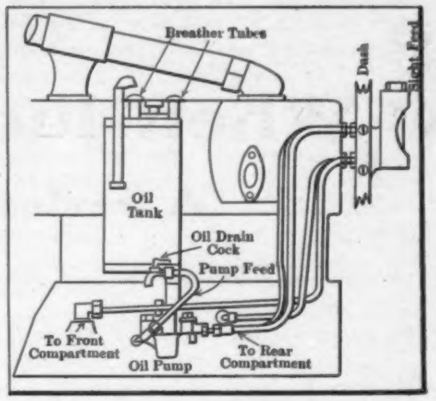


Fig. 8—Oil tank and connections for lubricating Packard cars of the latest type

Renault Oiling Scheme—The Renault cars are lubricated by the splash system. The oil is carried in the crankcase, which is filled through a filler opening located on the left-hand side of the motor just above the front axle of the car. The oil is taken by means of a pump driven by an eccentric and eccentric rod off the camshaft, and forced through a series of sight feeds located on the dash.

The sight feeds are marked by letters which stand for the French names of the parts which are taken care of by each of these oil leads. The leads are marked as follows: M.D., M.C., M.V. These three go to the motor itself, while the other two marked C.V. and E.D. (or E.A.) go to the gear box and rear axle, respectively.

The lead marked M.D. (moteur distribution) runs to the front main bearing; that marked M.C. (moteur central) to the central main bearing, and the one indicated by M.V. (moteur volant) to the rear of flywheel bearing. The amount of oil passing through each of these sight feeds may be adjusted to the requirements of each by turning the milled screws on top of the sight feed.

The connecting rods pick the oil from the series of troughs or compartments into which it is divided and throw it up into the cylinders. Besides lubricating the cylinders the oil is caught up by channels located in the upper part of the crankcase. These channels run longitudinally along the crankcase and are provided with small oil ducts above each bearing of the crankshaft. The oil will flow through these ducts by gravity to the bearings and from there into centrifugal oil rings on the shaft where it is naturally thrown by centrifugal force to the outer circumference of the ring.

Centrifugal force sends the oil into the crankpin, which has an opening so as to allow the oil to flow into the connecting rod bearing. The wrist pin will be lubricated also by the oil which works its way up from the splash, as well as that which is thrown there by centrifugal force.

To keep the oil in the splash troughs at constant level, the crankcase is divided into four transverse divisions. These may be put into communication with each other by means of a four-way cock which also drains the crankcase, separates the compartments and allows the oil to overflow to the correct level when there is too much oil in the splash troughs.

The change-speed box is packed in oil and grease which should be replaced occasionally. This can be done by removing the inspection cover. The flow through the sight feed into the lead to the change-speed box should show about fifteen drops per minute.

The remainder of the bearings all over the car are provided with grease cups or oilers.

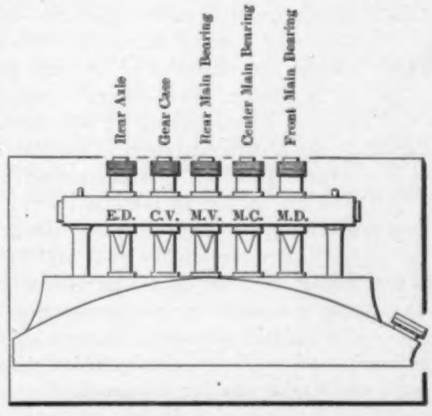


Fig. 9—Sight feed for oil connection on dash of Renault cars, with characteristic marks thereon

When Judgment Whispers Don't

A Series of Abbreviated Injunctions

DON'T discourage racing events and contests simply because they are difficult to control.

DON'T overlook the value of a "try-out" of an automobile under racing conditions—the weak spots float to the top.

DON'T try to build automobiles on a basis of pure theory—a real test welds theory to practice.

DON'T leave it to the purchaser to do the testing for the purpose of fixing the value of the product.

DON'T overlook the quality of the purchaser's money or the necessity of giving him an equivalent in the shape of a good automobile.

DON'T take it for granted that the automobile as made in your plant is good—a rigorous grind in a contest will develop that fact.

DON'T lay too much store upon circular track work—there is more to be learned during the length of a tour.

DON'T expect the control body to furnish honesty for you—it will have trouble enough keeping its own forces on the straight and narrow path.

DON'T be discouraged if a few false steps are to be found in tracing the past of contests—you have the whole future before you.

DON'T overlook the fact that however long the past may be it is but a moment as compared with the duration of the future.

DON'T mope if you are beset by a certain measure of failure—just make it a small percentage of the total and let the rest be success.

DON'T imprison a good idea in a poor setting—referring to an automobile, the good ideas will produce the right result if the car as a whole has been given a fair measure of attention.

DON'T practice mistakes after you find them out—the situation then becomes malicious.

DON'T incline the ear to drink in the story of the type of salesman who talks about everything but the subject in hand.

DON'T race with your money to put it in the coffers of the second-hand man before he races with the automobile to see if it is any good.

DON'T allow your incredulous smile to be supplanted by a serious look if the second-hand man gives you a more alluring version of the same story.

DON'T tap the boundless knowledge of the knave; there is no part of it that can be of any service to you.

DON'T permit yourself to be captivated by individuality; perhaps you need a good automobile instead.

DON'T pursue the business of buying an automobile according to a system that differs from the methods that you employ in the buying of real estate.

DON'T accept a demonstration if the car used has tires that are larger than the tire equipment of the automobile that you are taking an interest in.

DON'T overlook the importance of taking a demonstration in the particular automobile that you are to get.

DON'T harbor the fear that you will be giving the salesman too much trouble if you make him demonstrate the very automobile that you buy.

DON'T be satisfied with a wretched top on a good car—someone will take you for a ragman.

DON'T go in quest of a fool-proof automobile unless you belong to that fraternity.

DON'T expect that intelligent qualities will reside in a fool-proof car; intelligence never keeps such bad company.

DON'T cement your views to an incongruity, which is all that happens if you buy a car that is not in accord with your needs.

DON'T mistake a catalogue for the Bible, or forget that the maker's guarantee is in the back of the catalogue.

DON'T expect any more of redress from the maker than you will find reflected in the printed guarantee.

DON'T allow a salesman to make so little of you as to try to make you believe that his private guarantee will be underwritten by the maker of the car.

DON'T put your common sense up in camphor balls while you go to buy a car.

DON'T forget that you would have a fine automobile if you received the square root of the promises that are too often made.

DON'T boast of the speed that you can make with your car—somebody might get the impression that you are intemperate.

DON'T preach the doctrine of infallibility in connection with automobiles; the success of the automobile business depends upon the ultimate termination of the life of the cars.

DON'T assume that a good automobile should wear out before the purchaser gets a chance to pay for it.

Storage Battery Charging Equipment

THE study of the storage battery and its ailments is a subject which has not in the past received the attention it deserves at the hands of the average motor garage owner, and their charging is frequently placed in the hands of a youth who has no qualifications for undertaking this important duty, and yet on its proper discharge is frequently dependent the whole pleasure of the run. No garage owner who is alive to the welfare of his business can afford to ignore the advantages resulting from the installation of an up-to-date, efficient charging plant.

The storage battery, if properly looked after, is a piece of apparatus which will last for years, but no accessory on the car can be spoiled with such ease, a short circuit being sufficient to ruin the best of cells. The question then arises as to what method of charging best fits in with local conditions. In the towns it is an inexpensive matter to install a suitable plant, as a supply of electricity is almost always available, be it alternating or continuous.

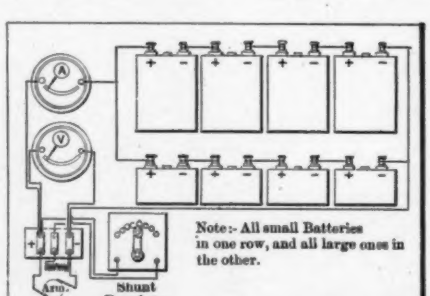


Fig. 1—Illustrating method of charging by a dynamo

CHARGING FROM A MAIN.—Should it not be known what the supply is, this can be easily ascertained from the supply company. If alternating current only is available, some form of trans-

former or rectifier is essential to convert it into continuous or uni-directional current, as alternating current theoretically surges backward and forward many hundreds of times a minute, first in a positive direction, then in a negative one, and if a storage battery is connected to this no charge is retained.

Charging from Alternating Current.—The transformer usually used consists of a motor wound for the alternating current circuit driving a continuous current dynamo; this set sometimes consists of a separate motor on a base coupled to a dynamo, but more usually the motor and dynamo are combined in one frame. The voltage on the secondary side of these transformers is always kept low in order that no waste is necessary in charging a small number of batteries, which will be explained later.

The rectifier is another method of converting alternating to uni-directional current for battery-charging purposes. The principle of the rectifier is to collect all positive and negative impulses and direct them to their respective terminals. It is usually made up of two parts—the incoming high voltage is led to a step-down static transformer, which reduces the voltage to a low figure, such as 6-8 volts, and this is then carried to an electro-magnetic rectifier, which synchronizes with the periodicity of the circuit on which it is fixed.

Charging from Continuous Current Mains.—If the supply is continuous current the choice of methods for charging is very much wider. The simplest, but by far the most extravagant, method of charging is by the use of lamps or resistances direct off the mains. This can be done by removing a lamp from its holder and inserting an adapter to which flexible leads are connected. A lamp or lamps should then be placed in circuit with the storage battery it is desired to charge, having first ascertained which is the positive and which the negative wire. This can be done by holding both wires in a cup of clean water about one-quarter of an inch apart with the current on, when bubbles will be seen to form on the negative wire. A good average rate of charge is 2 amperes for an ignition cell, and it will be necessary to connect six 16-cp. carbon lamps in series with the battery on a 200-volt circuit to carry this current, and half this number on a 100-volt circuit. This method of charging is not, however, to be recommended unless the light given by the lamps can be put to some useful purpose or charging is only very occasionally resorted to, as about 90 to 95 per cent. of the current consumed is absolutely wasted! Should, however, the number of batteries it is required to charge be large, say 30 to 40, then this method is to be recommended, as the above number of batteries will require practically the whole voltage of the mains if they are connected up in series.

The most efficient method, and the one usually adopted where it is required to charge a medium number of batteries off a continuous current supply, is by means of either a motor generator or a rotary converter.

The former consists of a motor wound for the voltage of the supply mains, coupled to a dynamo wound for a low voltage, such as 15 to 25. With these voltages the 4-volt batteries will be connected in three and five cells per row, and as many rows as the amperes will allow; the output of the dynamo can be varied by means of a shunt regulator, according to the number of batteries it is required to charge.

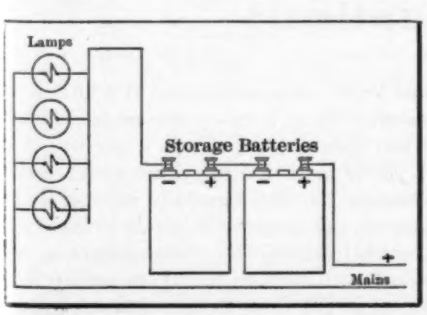


Fig. 2—Illustrating the method of charging a storage battery from a main, using lamp resistances for the purpose

The other method mentioned, viz., the rotary converter, consists of a single machine fitted with a commutator for collecting the current at each end, and a double set of conductors, viz., one set of fine wires connected to the mains or motor side, and a set of coarse wires connected to the secondary or dynamo side. This machine can be wound to give the same output as the motor generator mentioned above. Its advantages are: Slightly greater efficiency owing to the elimination of one pair of bearings, and the fact that this machine has only one pair of field coils instead of two; greater compactness; and less cost due to less material required in its manufacture. As a set-off to these advantages, any regulation required in output must be obtained through a series regulator, which is less efficient than a shunt regulator, and somewhat more expensive, but this latter machine has proved itself the more serviceable.

Charging by Dynamo.—Should no electricity mains be available, the problem before the man requiring to charge batteries is more serious. Some form of power is, however, necessary to drive this dynamo, be it gas or oil engine, gasoline or water motor. If the dynamo is required solely for charging purposes, the power required from the prime mover will be very small, 1-3 hp. being sufficient to charge as many as nine 4-volt storage batteries, but it is usually wise to install a larger plant than this and use the surplus for lighting purposes, as not only is electric light the very best and safest illuminant for the garage, but its cost compares favorably with even oil lamps. For instance, it is possible to light fifty 10-cp. metallic filament lamps for less than 3 cents per hour!

Having decided to install a dynamo, the question of the most suitable voltage arises. For all-around purposes 2 volts will be found the most satisfactory. With this voltage it will be necessary to connect the 4-volt batteries to be charged in series rows of five per row. Care should be taken in connecting up these rows to put, as far as possible, batteries of an equal size in the same row, as otherwise a small battery placed in a row with large ones will get too heavy a charge or else cause the large cells to be charged at a slow rate, which latter course, while not damaging them, will lengthen the time taken unnecessarily.

When the dynamo is lighting lamps at the same time as charging batteries, the voltage can, by means of a shunt regulator, be reduced according to the number of batteries it is required to charge. Thus, should there be only three 4-volt cells the dynamo must only give 15 volts, and so on. The regulation of the output of the dynamo obtained in this way is not at all extravagant, as the power required to drive it diminishes in the same ratio.

Another method of charging storage batteries is by means of a bichromate battery, but this method can only be recommended for use in the hands of an expert. This primary battery consists of a porous pot in which is a zinc rod amalgamated with mercury. This pot is placed in an outer jar in which is a solution of chromic acid and sulphuric acid. To charge one battery four primary batteries should be used. Each cell will give 1.1 volts.—*The Motor Trader,* May 24.

Merits of Zinc and Copper Alloys with Aluminum—For cheap aluminum castings a 33 per cent. zinc alloy with fusion point about 470 degrees centigrade is preferable, but for castings which must be particularly light and are subject to considerable deformation stresses an alloy with copper, though much more difficult to cast, meets the requirements better. There must first be made an alloy of 50 per cent. copper and 50 per cent. aluminum, which requires high heat and causes the formation of oxides and ashes. Commercially pure aluminum is added afterward, until the copper content is reduced to about 7 per cent., and the alloy has then a fusion point between 560 degrees and 622 degrees centigrade.

Canadian Exports—Automobiles to the value of $43,650 were exported from Montreal, Canada, during the fiscal year of 1910, as compared $28,400 worth of exports of motor cars in 1909. St. Johns, N. B., sent $34,100 worth of automobiles to the United States in 1910, which was a decrease in comparison with the 1909 exports, when the value was $37,770.

It Stands to Reason—

(Remembering That the Exception Proves the Rule)

THAT the advance guard among automobile designers is making progress every minute.

THAT the purchasing public would be in poor business dogging the advance guard.

THAT every device must be tried out before it is entitled to a certificate.

THAT trying it on the "dog" is the regular thing.

THAT the "dog" ought to know when he gets enough.

THAT trouble will come soon enough—lubricate the parts and don't wait until they signal that they are in distress.

THAT the success of any art depends upon a certain amount of "try-out" work.

THAT a great many things are being tried out that will never be standardized.

THAT standardization comes when the public puts its stamp of approval upon the product.

THAT sanctioned practice is really the practice that pulls money out of a prospective's pocket.

THAT a little temporary success on the part of an upstart is in the nature of a remote contingency as compared with sanctioned practice.

THAT to get the opinion of an upstart he will convey the impression that he is the whole "cheese."

THAT the men pulling in the traces and making the wagon of progress go are not even groaning under the load.

THAT all the noise comes from the fellow who gambles on an idea.

THAT the automobile business in the main is an established institution remote from the gambler's pavilion.

THAT there are many little odds and ends attached to the automobile art that can well be dispensed with.

THAT the shepherd of the automobile flock is counting his sheep with a good deal of care these days and the goats are being separated out.

THAT there can be no retreat from the present status of the automobile business—advance is the order of the day.

THAT there is too much merit in good means of transportation to permit the project to falter by the wayside.

THAT most of the complaining that is heard is from the type of man who has insufficient funds to buy a good automobile and too little nerve to risk the other kind.

THAT the conflict of thought as it affects the designing problem is being reduced to its lowest terms.

THAT the designer who chums with a poor original idea might better copy his master.

THAT every designer has a master in precedent.

THAT taking due notice of sanctioned practice is no reason why an improvement should not be made in the due course of time.

THAT failure is due to the man who quits improving because he has an investment in perishable tools.

THAT the purchasing public does not care a rap about the investment considerations—they are willing to foot the increased bill if the product reflects the difference.

THAT the man who does not know how to act wisely can get his marching orders from the purchasing public.

THAT the jaded nerves of a worn-out motor are scarcely to be improved by a monkey wrench in the hands of a novice.

THAT too many automobiles are put awry by the careless use of convenient tools.

THAT an automobile should not be subjected to a surgical operation if it is going about its business and keeping still.

THAT good service is the shadow of good management.

THAT short life is the product of a speed lust.

THAT the user of a car holds no brief to tell the designer how to improve upon his stock.

THAT the designer of an automobile is in poor business plugging up his ear against the complaints of users.

THAT success in the designing office comes with vigilance and alertness.

THAT satisfaction on the road is a matter of care and caution.

THAT the designer of an automobile has no more right to perpetrate a poor product than a user has to abuse a good car.

THAT a happy situation is reflected when the designer and the user work together.

Short Stories of Current Interest

Unraveling the Puzzling Situations

Of the many things that automobilists take an interest in, some of them are on debatable ground, but it is generally true of such matters that they can be reasoned out even after algebraic formulæ fail to serve the intended purpose; it is the idea here to reason out some of these situations.

EVERY known element and compound, if it is changed from a liquid to a gas, must boil in the process. Water boils at 212 degrees Fahrenheit under a pressure of one atmosphere. Other liquids have various boiling points, and gasoline, for illustration, if it is to best serve the purpose for which it is used in automobiling, must be so compounded that it will boil at the surrounding temperature. It is a too common belief that nothing can be made to boil unless it is put into a pot or other form of receptacle and placed over a fire. This belief melts under the impetus of secondary thought, especially when it is remembered that some elements and compounds obtain only in the gaseous state under the normal conditions of temperature as we know it. The more volatile constituents of the hydro-carbon that is used to obtain gasoline are in gas form at the normal temperature, and for that matter it is scarcely believed that anything below hexane is sufficiently stable to constitute a good liquid to put in the gasoline tank. In the various fractions of hydro-

carbons, so it would seem, there is a wide choice, beginning with the fractions that boil at the temperature of the surrounding air are slightly below and ending with the fractions that can only be made to boil when the air that is sent through the carbureter is preheated. The right time to stop off is when the fractions are so non-volatile that they cannot be induced to boil excepting in the greater heat of the combustion chamber.

WHEN carbon forms in the combustion chamber of the cylinder of a motor the operator of the car is made aware of the fact due to the cranky performance of the car under such conditions, and yet the explanation for this cranky performance presents a difficult situation to cope with. It is claimed by many designers of motors that the thermal efficiency will be on a higher plane if heat is prevented from getting out of the cylinder into the cooling water, and a coat of scale over the combustion chamber surfaces retards the flow of heat through the cylinder to the cooling water, so that in a sense the very deposit of carbon to which exception is taken is beneficial in its presence because it retards the flow of heat and conserves the useful measure of the same, thus increasing the power of the motor and decreasing the necessity for circulating cooling water. The effect of carbon in the combustion chamber is more marked as the compression of the motor is increased, and we must reach the conclusion that the placing of a layer of scale over the inner surface of the cylinder has the same effect to some extent as increasing compression. According to this method of reasoning it would be possible to increase the efficiency of the motor by putting a coat of scale over the flame-swept surfaces as well as by increasing the compression, since both methods seem to have the effect of increasing the rate of flame travel in the burning mixture. Following this thought a little longer makes it possible to reach the conclusion that there might be some advantage in running a motor under conditions of relatively low compression and courting the growth of the coat of carbon over the flame-swept surfaces in the cylinders. It has been found in practice that a motor acts precisely the same if the compression is 95 pounds (absolute) per square inch as when the compression is 10 or 15 pounds lower, and a coat of scale is permitted to grow over the flame-swept surfaces. It has been found also that with a compression of about 75 pounds per square inch (absolute) the effect of carbon deposit is materially reduced, and it might be that with a pressure of 60 pounds (absolute) per square inch the effect of the carbon growth would be so reduced that its presence might be disregarded.

WHILE the Society of Automobile Engineers were attending the Summer Meeting at Dayton, Ohio, a few days ago, there was quite a little discussion bearing upon the relation of a designing engineer to the man who purchases and uses a freight automobile. Some of the experts present advocated the employment of a second engineer, whose duty it would be to tell the designing engineer what the purchaser wants and whose second duty would fall in the direction of telling the purchaser how to conserve his investment and get a return on the same. There is some merit in the idea of using two kinds of engineers in this large commercial undertaking. It must be remembered that the designing engineer in the plants in which automobiles are made has a strong influence brought upon him for the worthy purpose of standardizing the output of the plant, and it would be nothing very unusual were the engineer to encourage the thought that one type of freight automobile should serve all the different kinds of users, and yet the point must not be overlooked that the wish is father to the thought. It is highly improbable that one type of automobile can be made to serve under all the commercial conditions to which freight automobiles offer advantages, and it is more than likely that an efficiency engineer who studies the wants of users of freight automobiles will be the best judge of the modifications of the main plan that must be indulged in ere the result will be satisfactory.

Calendar of Coming Events

Handy List of Future Competitive Fixtures

Race Meets, Runs, Hill-Climbs, Etc.

July 5-22..........Winnipeg, Man., Fourth Canadian Competition for Agricultural Motors.
July 7..............Taylor, Tex., Track Races, Taylor Auto Club.
July 8 or 15.......Philadelphia, Track Races, Belmont Park, Norristown Auto Club.
July 14............Philadelphia, Commercial Reliability Run, Quaker City Motor Club.
July 15............Guttenberg, N. J., Track Races.
July 15-17........St. Louis, Mo., Reliability Run, Missouri Automobile Assn.
July 17-19.........Cleveland, O., Three-Day Reliability Run of the Cleveland *News*.
July 17-22.........Milwaukee Reliability Run, Wisconsin State Automobile Association.
July 21-22.........Brighton Beach, N. Y., Twenty-four-Hour Race.
July 20-28.........Minneapolis Reliability Run, Minnesota State Automobile Association.
Aug. 1.............Chicago, Ill., Commercial Reliability Run, Chicago *Evening American*.
Aug. 3-5...........Galveston, Tex., Beach Races, Galveston Automobile Club.
Aug. 12............Philadelphia, Reliability Run, Quaker City Motor Club.
Aug. 12............Worcester, Mass., Hill Climb, Worcester Automobile Club.
Aug. 17............St. Louis, Mo., Reliability Run, Missouri Automobile Assn.
Aug. 25-26.........Elgin, Ill., Stock Chassis Road Race, Chicago Motor Club.
Sept. 1............Chicago, Ill., Commercial Reliability Run, Chicago Motor Club.
Sept. 1............Oklahoma, Reliability Run, *Daily Oklahoman*.
Sept. 2-4..........Brighton Beach, N. Y., Track Races.
Sept. 2-4..........Indianapolis Speedway, Track Races.
Sept. 4............Denver, Col., Track Races, Denver Motor Club.
Sept. 7-8..........Philadelphia, Track Races, Philadelphia Auto Trade Association.
Sept. 7-9..........Hamline, Minn., Track Races, Minnesota State Automobile Association.
Sept. 12-13........Grand Rapids, Mich., Track Races, Michigan State Auto Association.
Sept. 15...........Knoxville, Tenn., Track Races, Appalachian Exposition.
Sept. 16...........Syracuse, N. Y., Track Races, Automobile Club and Dealers.
Sept. ....Denver, Col., Track Races, Denver Motor Club.
Oct. 3-7...........Danbury, Conn., Track Races, Danbury Agricultural Society.
Oct. 7.............Philadelphia, Fairmount Park Road Race, Quaker City Motor Club.
Oct. 9-13..........Chicago, Ill., Thousand-Mile Reliability Run, Chicago Motor Club.
Oct. 16-18.........Harrisburg, Pa., Reliability Run, Motor Club of Harrisburg.
Oct. ....Atlanta, Ga., Track Races, Atlanta Automobile Assn.
Nov. 1.............Waco, Tex., Track Races, Waco Auto Club.
Nov. 2-4...........Philadelphia, Reliability Run, Quaker City Motor Club.
Nov. 7-10..........Los Angeles-Phoenix Road Race, Maricopa Auto Club.
Nov. 9-11..........San Antonio, Tex., Track Races, San Antonio Auto Club.
Nov. 10............Phoenix, Ariz., Track Races, Maricopa Automobile Club.
Nov. 28-30.........Savannah, Ga., Vanderbilt and Grand Prix Races, Savannah Automobile Club.
Nov. 30............Los Angeles, Cal., Track Races, Motordrome.
Dec. 25-26.........Los Angeles, Cal., Track Races, Motordrome.

Foreign Fixtures

July 9.............Sarthe Circuit, France, Grand Prix of Automobile Club.
July 13-20.........Ostend, Belgium, Speed Trials.
July 21-24.........Boulogne-sur-Mer, Race Meet.
Aug. 6.............Mont Ventoux, France, Hill Climb.
Sept. 2-11.........Roubaix, France, Agricultural Motor Vehicle Show.
Sept. 9............Bologna, Italy, Grand Prix of Italy.
Sept. 10-20........Hungarian Small-Car Trials.
Sept. 16...........Russian Touring Car Competition, St. Petersburg to Sebastopol.
Sept. 17...........Semmering, Austria, Hill-Climb.
Sept. 17...........Start of the Annual Trials Under Auspices of *l'Auto*, France.
Oct. 1.............Gaillon, France, Hill-Climb.
Oct. 12-22.........Berlin, International Automobile Exhibition.

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The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

WIDE interest is being taken in the types of motors that do not depend for their proper functioning upon poppet valves, and the supporters of the automobile industry are about to have an opportunity to inspect and try American-made Knight sleeve types of motors, as they are being manufactured by four companies of tried experience. In addition to this concrete effort, there is a strong undercurrent, with particular attention being paid to other forms of this broad idea, and the interested investigator will be struck by the diversity of effort and the impetus that is being given to original investigation in the face of the fact that designers who have had their nests well feathered are trying to teach the world to accept their marvelous handiwork as the last word.

* * *

TO the man who rests upon his hard-earned laurels, an early death and a heavy monument is all that the world affords; but we cannot bring ourselves to believe that glory in this form has any more compensations than will come to the progressive struggler who refuses to believe that finality hovers in the offing, and who goes on sweeping obstacles aside, holding tenaciously to the idea that there is something better higher up. As against the loud cry deprecating the annual model idea, the automobile industry is confronted by a more persistent and potent situation and the patrons of the industry are about to enjoy an opportunity to test the acumen of the builders, who seem to go on the principle that if there is nothing ventured there is nothing gained. It would be a foolhardy attempt on the part of a novice to try to market something new just because it is different; but there is a great difference between an innovation for sensation's sake and the supplying of a real demand.

* * *

JUST as refined society is conspicuous for its well-bred silence, so it may be said of a motor. If it does its work silently and well it will occupy a social throne motorwise that will attract the discriminating attention of the man who expresses a preference for the refined instead of encouraging the antics of the brawler. The time was when a silent motor was past believing, and the only hope that was entertained had for its foundation the thought that quite a little of the disconcerting sounds might be wrung out of the average motor. It is not believed that the purchaser of an automobile will concern himself overmuch relative to the scheme of design and the details of construction of motors in general, provided motors as used will do the work for which they are intended; on the further count, however, that the user thereof can take the evidence of his own ears and say to himself that the performance of the motor is silent.

* * *

UNEXPECTEDLY the builders of well-performing motors from the noise point of view were confronted by a strange situation. When they got the noise out of the valve mechanism they found that it had taken up its abode in the halftime gear system and in the drive for the magneto, water pump, and lighting dynamo. These relatively puny noises must have been in motors all of the time, but they sank into insignificance in comparison with the considerable clatter of the valves, only to be discovered when these great noises were removed. It was only half the battle to pay attention to the proper contriving of valve mechanism, and the other half of the struggle is being taken care of by the introduction of silent chain drives. Fortunately for the builders of all types of motors, the use of the silent chain is free to all, and we gather the impression that even the most inexpensive types of poppet-valve motors, as they will find a use in popular-priced cars, will vie in point of silence with their more pretentious brothers, due to the use of chain drives and the strangling of the grind that comes in the trail of ill-fitting gears.

* * *

FLEXIBILITY is the condition that makes it possible for a locomotive to start a train of 100 freight cars, and this desirable property is at no greater cost than the use of a spring in the coupling; and this flexibility, in addition to facilitating the work of starting, has a marked and favorable bearing upon the equipment. In the same way the presence of flexible members in the driving equipment of an automobile facilitates in the acceleration of the mass and saves the members in the machinery equipment from the ills of shock. There are two ways at the disposal of designers to overcome the ills of shock, one of which has to do with the use of dynamic steel at a price; but the second and perhaps the best way lies in the elimination of the shock. One of the distinct and desirable advantages attending the use of the silent chain lies in this very flexibility, the presence of which is the best guarantee that shock does not have to be entertained.

Fate of Dirt Tracks in Balance

M. C. A. to Take Action on Racing Next Month

Whether automobile racing on circular dirt tracks shall be continued or not on present lines will be the subject to be considered at the next meeting of the Manufacturers' Contest Association. The proposition will be taken up from all viewpoints, and the action that develops will likely be along the line of restricting racing of this kind. One point in particular will be considered, the methods of settling dust by other means than water in preparing for races. Sweeping prohibitory action would leave New York without racing representation for the present at least.

WHAT shall be the fate of dirt-track racing is a problem that has an interest for a circle considerably wider than that comprising motordom and it will be settled, according to announcement, by the Manufacturers' Contest Association at its coming meeting in August.

Automobile racing on the general run of county fair tracks that have not been specially prepared for such use has its dangers and certainly lends an element of peril to contests that is absent on the speedway or upon the specially prepared dirt track.

If general action should be taken by the association barring racing on all dirt tracks the situation in New York would be disconcerting. One thing seems to be certain and that is that the present situation will not be broadened. Therefore if action is taken it will likely be restrictive.

The association has issued the following bulletin covering the subject:

"One very important subject which will be given most careful consideration at the general meeting of the Manufacturers' Contest Association, to be held in August will be the question of racing upon circular dirt tracks. All over the country there are in existence one-mile circular dirt tracks built for horse-racing. The popularity of the automobile and of automobile competitions has prompted county and State fair organizations to feature racing among the head-liners of the "big days." In addition to this, racing events on circular dirt tracks are being advertised by individual promoters who have in mind the possibility of a considerable financial return in the way of gate money.

"At a meeting of the Active Rules Committee held in Detroit on June 19 it was the consensus of opinion that decisive action should be had at the August meeting for the restriction of circular track racing. Whether racing of this kind upon mile dirt tracks should be legislated against by the governing body, or whether sanction for circular-track events should be granted only after an entire reconstruction of the track surface and surroundings and some adequate provision other than the use of water has been made for laying the dust, are open questions. In any case, the situation requires decisive action."

Everybody Experimenting with Motors

Recent developments with regard to the sleeve type of motor have uncovered a tremendous line of activity in motor building. It may be said with conviction that practically every manufacturer of automobiles in the world has been experimenting with some new kind of a motor this year.

Many of them are doing this openly, but in the majority of cases the investigations have been carried along with more or less secrecy. In a few instances the fact that the experiments are being made has been officially denied but unofficially confirmed.

The result of course is problematical, but with the adoption of the sleeve motor by several well-known companies, it is apparent that most of the others have been active in looking into the merits and demerits of various sorts of motors not represented by the formal poppet valve types.

Of these there are fifty-five different species ranging through the entire gamut of motor construction. The poppet valve motors generally follow somewhat similar lines and opposed to them is a staggering array of other varieties.

The field of choice offered to the manufacturer is wide and as a consequence the investigation and experimentation have been conducted upon broad lines.

Blue Book Fleet to Rival "Stunt" Cars

With its road work department equipped with three six-cylinder Thomas cars of high power, the Official Automobile Blue Book is about to enter upon its preliminary work for next year. The cars, manned by members of the staff of the publication, will start out this week on tours which for size and length rival the dreams of all the "stunt" car publicity agents rolled into one. The team will cover all the Blue Book routes lying between the crest of the Rocky Mountains and the Atlantic Ocean north of Miami, Florida.

All told, the routes foot up to a total of something over 75,000 miles and in addition to that vast amount of touring the cars will seek out other routes.

In making these tours the utmost pains are used to localize every landmark, branch road, fork, schoolhouse, cemetery and church so that the users of the routings may have the advantage of the careful work of the map-makers. Every branch road is covered with care, even though it does not form a part of any of the published routes. Every fork is investigated as to where it terminates.

Using a rapid schedule it will require all the time between now and the deadlock of Winter to cover the ground. The reason for this is that every road, whether it is a part of any route or not, is carefully measured with the odometer and checked with other instruments.

It is the announced intention of the management to enlarge and improve the Blue Book of 1912 along the same lines laid down in the current work. This will mean more detailed information about the roads and if possible more complete hotel directions.

T. C. A. Warns of Speed Traps

SYRACUSE, N. Y., July 3—Automobilists of this city and vicinity are interested in the measures that are being taken by the Touring Club of America properly to warn drivers against the existence of speed traps, of which there are a number in this vicinity. They have been springing up of late through the mistaken zeal of that small but troublesome part of motordom known as speed maniacs. The T. C. of A. is taking measures to warn motorists of the traps and at some of them scouts are to be placed on Saturdays and Sundays to issue proper warning to tourists.

A—Paige-Detroit competing in first event. B—At the starting line on Ossining Hill. C—Wilson's National winning the amateur event. D—Summer visitors watched the races with much interest

Nationals Sweep Ossining Card

Indianapolis Cars Win Four Races on Hill

Four events in which they were entered out of five programed at the annual hill climb of the Upper Westchester Automobile Club fell to the lot of National cars on Saturday at Ossining, N. Y. The other race was taken by a Mercer car. There was little sustenance derived by the foreign speed monsters in this hill-climb as the 200-horsepower Fiat finished last in the Free-for-all with a balky carburetor and the special Mercedes could do no better than second in both events in which it started. A big crowd enjoyed the proceedings.

OSSINING, N. Y., July 1—Before a crowd of natives and Summer visitors estimated at about 6,000 persons the Upper Westchester Automobile Club conducted its annual hill climbing contest to-day under delightfully favorable conditions.

The hill was rather easy and was not long and all the cars experienced no trouble in negotiating it. The running off of the card proved to be a clean sweep for the fleet of Nationals that were entered in four of the events. The foreign speed monsters were obliged to bow to the flight of the powerful blue car driven by Len Zengel, who won fame ast Fall by annexing the Fairmount Park Race in a hair-raising finish.

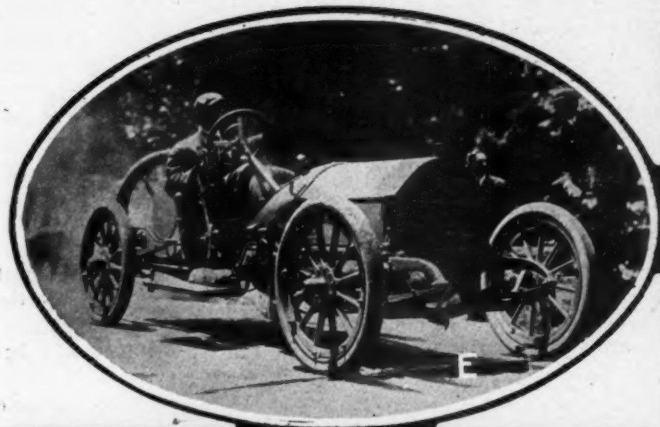
In two events this car was first at the wire, they being its division of Class C and the Free-for-all, in which it defeated such cars as the Arnold Fiat of 200 horsepower driven by Bruce-Brown and the Mercedes monster that ran so well at Indianapolis.

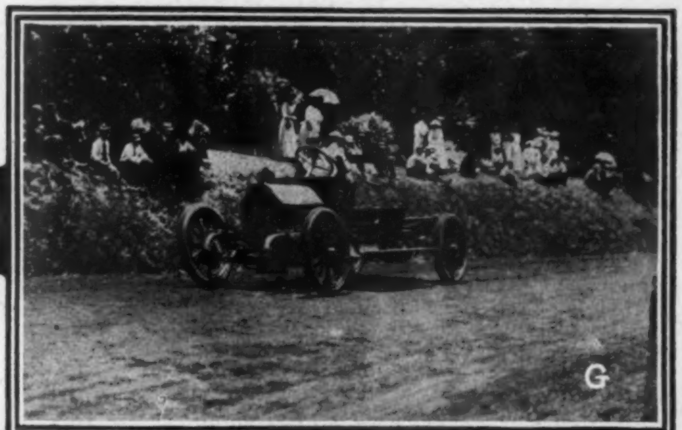
The first race on the program was originally intended for stock cars and was so carded, but its real status was Class E. There were three entries, a pair of Mercers and a Paige-Detroit. Mercer No. 1 proved the speediest and turned the hill in 48 1-5 seconds. The other Mercer was second, four seconds slower and the Paige-Detroit was placed third. The Mercers are considerably larger in piston displacement measurements than the Paige and all three competitors were actually stock cars.

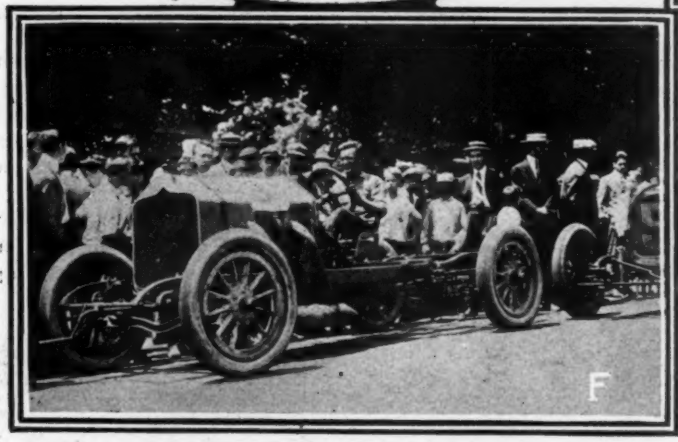
The second race found three Nationals opposed to a Pope-Hartford. No. 4 made a fast climb in 38 seconds and won rather easily, with No. 6 National and the Pope-Hartford separated by only one-fifth of a second for the place. The National that finished last was only three-fifths of a second behind the Pope.

In the race for cars of from 450 to 600 cubic inches piston displacement National No. 8 made the fastest time of the day and won from the Indianapolis Mercedes by one-fifth of a second. The Pope was a distant third.

The club race for cars owned and driven by members of the Upper Westchester Automobile Club attracted only three starters. National No. 12 finished the climb in 45 1-5 seconds, beating the Stearns and the Mercer. There were handicap con-







E—Winning Mercer car in event No. 1. F—Double winner of the day, a National. G—Stearns car made a good showing in club event. H—When the word was given to start in one race

ditions in this event but they did not serve to alter the placing of the cars.

The big race of the day was the Free-for-all, last on the program. In this there were five starters including two Fiats, Mercedes, Pope and National. The latter equaled its fast run in the class race mentioned above, 33 4-5 seconds. The second car turned up in the Indianapolis Mercedes, one second slower, while the fully equipped Fiat car, No. 14, was third in 37 1-5 seconds. The Pope came fourth and the big Fiat, coughing and sputtering with carbureter trouble, just managed to wabble past the finishing line in 42 4-5 seconds.

The event had a distinct flavor of finance about it as three of the competing drivers, all of whom hold professional credentials, are rated above the million-dollar mark. They are: Bruce-Brown, Wishart and Bragg. Three other drivers are also considered rich men in a comparative sense, Disbrow, Rutherford and Sherwood.

The hill is hardly long enough and difficult enough to afford a setting for a hard test. It is not equal in any way to Sunset hill that has been used heretofore. The starting point was at the limits of the village of Ossining on the north side and the course was laid out 2,814 feet toward the center of town. The whole hill has an average grade of 6 1-2 per cent. and a maximum of 11 1-2 per cent. There is one curve of about 15 degrees.

There was nothing that looked like an accident during the afternoon and the races were conducted with commendable speed after the first car was sent away. A. F. Camacho represented the Contest Board and A. J. McShane was referee. The summary:

Class E, Special for 160-300 Cars

Number	Car	Driver	Position	Time
1	Mercer	Van Wyck	1	:48 1-5
3	Mercer	Sherwood	2	:52 1-5
2	Paige-Detroit	Craig	4	:58

Class C, Division 4, for 301-450 Cars

4	National	Bragg	1	:38
6	National	Rutherford	2	:39 4-5
5	Pope-Hartford	Disbrow	3	:40
7	National	Tierney	4	:40 3-5

Class C, Division 5, for 451-600 Cars

8	National	Zengel	1	:33 4-5
9	Mercedes	Wishart	2	:34
5	Pope-Hartford	Disbrow	3	:41

Class E, for Cars Owned and Driven by Members of Upper Westchester A. C.

12	National	Wilson	1	:45 1-5
11	Stearns	Wallace	2	:47 2-5
3	Mercer	Sherwood	3	:51 2-5

Class D. Free-For-All

8	National	Zengel	1	:33 4-5
9	Mercedes	Wishart	2	:34 4-5
14	Fiat	Stuart	3	:37 1-5
5	Pope-Hartford	Disbrow	4	:40 1-5
15	Fiat	Bruce-Brown	5	:42 4-5

Newark Club Plans for New Home

Newark N. J., July 3—The New Jersey Automobile and Motor Club has inaugurated a campaign to raise $25,000 for the erection of a country clubhouse. The plan provides for a nine-hole golf course. Several sites, within a short run of Newark, are under consideration. The club's present lease on the Lake Apshawa club house expires in 1912.

The contest committee of the organization is arranging for an endurance run to take place in September. While nothing definite has been settled on, the affair, it is said, will be either a twelve-hour or twenty-four-hour contest.

Foster to Spend $200,000,000 on Roads

Pittsburg, July 3—County Road Engineer S. D. Foster has recently been appointed first assistant to E. M. Bigelow, Chief Road Engineer of Pennsylvania, who will have charge of the expenditure of more than $200,000,000 for good roads in the Keystone State. It is likely that the Automobile Club of Pittsburg will take action expressing regret at his departure at the next meeting. Before Mr. Foster's leaving the employees of the county engineer's office presented him with a fine gold watch and fob.

Big Crowd Sees Mile Record Fall

Brighton Beach Two-Day Meet a Success

Seventeen races, practically all of which developed a struggle somewhere in their various courses, as well as a mile trial against time that set a new mark for the distance, were the offerings set before the public at the two-day race meeting that was held at Brighton Beach July 3-4. The keenest and most spectacular of the struggles that were staged came in a race that gave little promise of any such thing, the free-for-all handicap of July 4, when an E-M-F racing car just lasted long enough to nose out a Pope-Hartford in the most remarkable finish ever made at the track.

TO a full house the automobile racers played on Independence Day at Brighton Beach. The crowd of 5,000 persons who witnessed the races on the preceding day was tripled in honor of the holiday and all around it was a delightful and successful day's sport. There were seventeen races decided during the two days and for good measure the one-mile circular dirt track world's record was lowered by one-fifth of a second. Not an accident marred the sport during the running of the cards.

The feature race of the meeting was the struggle for the Remy brassard and the $75 a week that goes to the driver of the winning car and as was predicted in THE AUTOMOBILE the big end went to the big special Benz car and the $75 a week must be paid to Burman, unless he has some arrangement with the manager of his stable by which the "salary" will go into the stable's treasury to pay railroad fares and such things.

The "stable" which is managed by E. A. Moross, who also promoted the race meeting, did very nicely all told. Besides the brassard race, two Class E races were won by its representative in the person of another Benz car driven by Patschke. In the bigger division of this class, however, something must have slipped for Simplex 2 took down first money on the opening day and National 33 gathered the shekels on July 4.

Despite these drawbacks the stable must have done well because the "gate" was satisfactory.

There were no stock car races and consequently the spectacle afforded was simply a spectacle, but it was a mighty interesting one.

The first event of the first day attracted a field of seven starters. The E-M-F entry got away flying and won all the way by a fair margin. Paige-Detroit 29 broke second and followed the pace for nearly 2 miles, when it gave way to the Lancia. At the finish the winner was eased up in 5:43.86 and the Lancia took the place handily. All three Paige cars finished.

Event No. 2 was for Class C cars of division 3, 231-300 cubic inches piston displacement at five miles. Five cars appeared on the starting line, two of the scratched cars being S. P. O. 14

2—How six thousand spectators viewed the Independence Day races

and Mercer 31, the drivers of which had met fatal accidents before the opening of the races. The Mercer contestant had the speed of the party and led from end to end, winning in the fast time of 4:55.51. Correja 8 was second all the way and S. P. O. 15 worked its way into third position at the end. The Schacht did not have its burst of speed and the Marion went out with tire trouble.

The "stable" got its first taste of glory in the next race which was for Class E cars, 301-450 cubic inches displacement. Two Nationals, a Benz and a Jackson formed the field. National 10 took up the pace in the early stages and appeared to have the foot of the party. But in the fourth mile the Benz came along under Patschke's handling and nipped the contender. The Benz went on to win handily in 4:42.47. The Jackson suffered with ignition trouble and was never prominent.

1—Making the far turn in the first heat of the Remy Brassard race

Simplex 2 had a nice easy run in the next number, winning from three Nationals and the Benz car that got the purse in the foregoing event.

The novelty race developed no novelties and not much of a race. The cars were required under the rules to load passengers at the end of the first mile, discharge them at the end of the second; load them at the third; discharge them at the fourth and finish without passengers. A Hudson car had too much speed for the Colby that contested against it. The Hudson won in 8:11.56, including the time lost in making the four stops and five standing starts.

Next came the first heat of the Remy brassard race at three miles, flying start, free-for-all. Five cars faced the starter, including the Blitzen Benz, plain Benz and Mercedes, from the

3—Line-up of the cars in Event No. 4, on the first day

Moross stable; National 33 of the Poertner Motor Car Company and Simplex 2 from the Simplex Automobile Company. After one false start, the cars came down to the line in a fairly good rank and the red flag signaled them to go. The plain Benz soon settled into a short lead, taking the pole position while out toward the center of the track the Blitzen lay second. In behind the leader, the Simplex ran along in third place, pocketed from wire to wire in such a way that, skillful driver though he is, De Palma could not get through. The others trailed throughout. The plain Benz finished first by a short margin with the Blitzen second and Simplex third. The time was 2:41.68.

Simplex number 20 was eligible to start in this event but the driver's card held by Ormsby had been suspended by the referee for the part the driver had taken in the accident that led to the death of H. Frey earlier in the day and the destruction of Mercer 32.

Event number 7 was changed from a one-hour race to a grind of 60 miles and drew out a fine field of eight starters. Simplex 2 won all the way without being extended. Second place went to Mercer 32, which worked its way up from fourth position. It was about 2 miles behind the winner and 1 1-2 miles ahead of Marion 13, which came third. The race was marked by a bit of sensational driving on the part of the pilot of Pope-Hartford 18. Disbrow blew a right rear tire making the paddock turn in the thirty-eighth mile and managed to bring the big machine to a stand just touching the fence after a plunging flight along the rail for over a furlong. The car was set going again in a short time and was a factor until the beginning of the final spurt, when tire trouble retired it.

4—The grandstand was not crowded on July 3

The trophy in this race was the W. B. and $100 in gold.

The last event of the day produced an unusual mixup and an unusual ruling on the part of the officials. It was a free-for-all handicap in which 14 cars presented themselves for the start. The word was given to the three Paige-Detroits which were to receive the limit handicap and when the Paiges started, six other cars went along. At the end of the mile it looked very much like a jam but the net results were the loss of a wheel by one of the Paige cars. The referee then refused to allow any of the six cars that had taken part in the breakaway to compete. These were the Crow 5; Correja 8; Marion 13; S. P. O. 15; Lancia 16 and E-M-F 19.

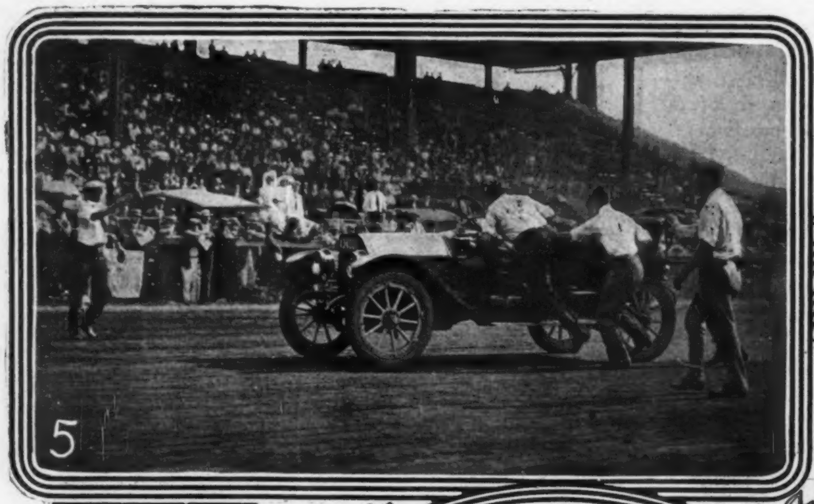
The race proved rather easy for Mercer 32 with Simplex 20 second and Pope-Hartford 18 third. Time 5:33.53.

On July 4, the big Benz, under Burman's handling, lowered the dirt track record one-fifth of a second and won the Remy brassard by taking two successive heats from the plain Benz. Patschke, driving a dark horse known as the Jenatzy Mercedes, made one surprising spurt in this event and for a moment headed his colleagues on the far turn. The Jenatzy, however, was not up to much and flattened out after that single flash.

The card included a free-for-all handicap which was won by the E-M-F by the length of its hood from the fast coming Pope-Hartford. The brush through the stretch between these two cars was the closest and most terrific bit of driving of the afternoon. The handicap of the E-M-F was sufficient to give it a start of practically half a mile and as the pace was rather easy in the first two miles the Pope-Hartford had to come with keen speed to draw the finish so close.

The Correja won Class C, Division 3C, event with ease, finishing ahead of the Marion and Crow.

The Prince Henry Benz had a cake-walk in the fourth event, but National 33 defeated it and several others in the next class. Then came the foreclosure of the mortgage on the brassard as stated. National 33 won the Australian pursuit race after a fierce struggle. National 10 was put out first in this race by being passed by Simplex 20 and, in turn, National 33 put out the Simplex. This left only the Pope-Hartford and National 33 in the race and after a fierce drive of 23 miles the Pope blew a tire in front of the stand and in sight of 15,000 people the pilot racked the steering wheel in response to the reeling of the wounded car and brought it to a safe stop in front of the judge's stand.




5—Passengers scrambling into the Hudson, winner of the novelty race
6—Line-up for the 301-450 race on the first day—Benz, two Nationals and a Jackson
7—Start of the 60-mile race, which was won by the Simplex, Mercer second, Marion third
8—The E-M-F, Jack Tower driving, which won three races

A small class race was won by the E-M-F which was not on the program and was probably inserted to make up for the fact that most of the cars that took part had been barred from the free-for-all handicap of the previous day.

One of the most interesting races of the meeting was the last one carded for July 4. It was at 50 miles and brought out a field of six. Pope-Hartford won rather handily after the two Nationals had succumbed to tire trouble. The Jackson car was second and the Crow, carefully and conservatively driven by Otto F. Rost, General Eastern Agent of the company, was third, The Crow did not go to the pits for tires or anything else and was running considerably faster at the finish than earlier in the race. It was last to get away and maintained a steady pace all the way through and as one car after another went out from tire or motor troubles it forged toward the front. At the rate the last 10 miles were run, it would have won had the race been 60 miles long.

JULY 3—FIRST DAY

Division 2C for cars of 161-230 cubic inches, Five Miles.

Number	Car	Driver	Position	Time
19	E-M-F	Tower	1	5:43.86
16	Lancia	Ferguson	2	
29	Paige-Detroit	Craig	3	
30	Paige-Detroit	Shannahan	4	
27	Paige-Detroit	Regan	5	
24	Regal	Tate		
12	Hudson	Mulligan		

Division 3C, 231-300 cubic inches, Five Miles.

Number	Car	Driver	Position	Time
32	Mercer	Hughes	1	4:55.51
8	Correja	Forstur	2	
15	S. P. O.	Juhasz	3	
9	Schacht	Gray	4	
13	Marion	Anderson	5	

Class E, 301-450 cubic inches, Five Miles .

Number	Car	Driver	Position	Time
4	Benz	Patschke	1	4:42.47
10	National	Sheets	2	
26	National	Knipper	3	
34	Jackson	Cobe	4	

Class E, under 600 cubic inches, Five Miles.

Number	Car	Driver	Position	Time
2	Simplex	De Palma	1	4:45.93
33	National	Zengel	2	
10	National	Sheets	3	
4	Benz	Patschke	4	
26	National	Knipper	5	

Novelty Race, Five Miles

Number	Car	Driver	Position	Time
7	Hudson	Lame	1	8:11.56
35	Colby	Tyrock	2	

Class D, Remy brassard. First Heat, Three Miles, Flying Start.

Number	Car	Driver	Position	Time
28	Benz	Knipper	1	2:41.68
1	Benz	Burman	2	
2	Simplex	De Palma	3	
33	National	Zengel	4	
3	Mercedes	Telzlaff	5	

Class E, under 600 cubic inches, Sixty Miles, for W. B. Trophy.

Number	Car	Driver	Position	Time
2	Simplex	De Palma	1	59:21.37
32	Mercer	Hughes	2	
13	Marion	Anderson	3	

Class D, Free-for-All Handicap, Five Miles.

Number	Car	Driver	Position	Time
32	Mercer	Hughes	1	5:33.53
32	Simplex	Lund	2	
18	Pope-Hartford	Disbrow	3	

JULY 4—SECOND DAY.

Class D, Free-for-all Handicap, Five Miles.

Number	Car	Driver	Position	Time
19	E-M-F	Tower	1	5:39.77
18	Pope-Hartford	Disbrow	2	
29	Paige-Detroit	Craig	3	

Division 3C, 231-300 cubic inches, Five Miles.

Number	Car	Driver	Position	Time
8	Correja	Forstur	1	5:33.81
13	Marion	Anderson	2	
5	Crow	Rost	3	
15	S. P. O.	Juhasz	4	

Class E, 301-450 cubic inches. Five Miles.

Number	Car	Driver	Position	Time
4	Benz	Patschke	1	4:43.39
18	Pope-Hartford	Disbrow	2	
26	National	Knipper	3	

Class E, under 600 cubic inches, Ten Miles.

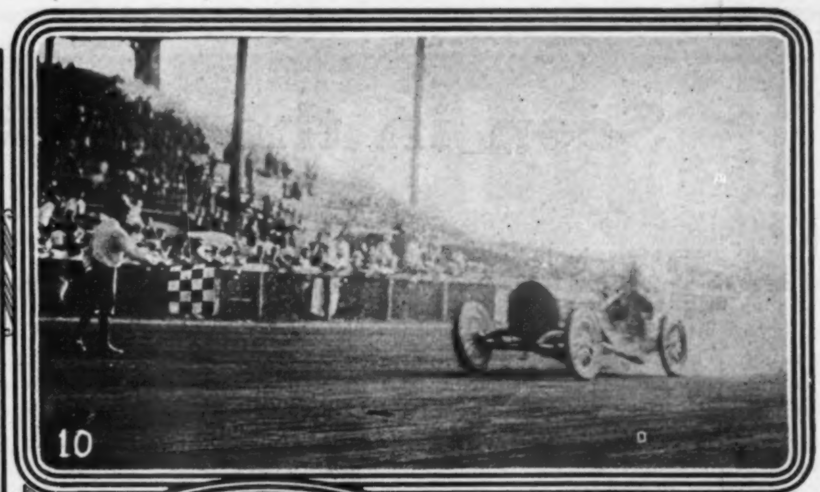
Number	Car	Driver	Position	Time
33	National	Zengel	1	9:16.81
10	National	Sheets	2	
18	Pope-Hartford	Disbrow	3	

Class D, Three Miles. Second Heat, Remy contest.

Number	Car	Driver	Position	Time
1	Benz	Burman	1	2:37.38
28	Benz	Knipper	2	
3	Mercedes	Patschke	3	

Final Heat.

Number	Car	Driver	Position	Time
1	Benz	Burman	1	2:56.08
28	Benz	Knipper	2	
3	Mercedes	Patschke	3	



9—Burman in the Blitzen Benz breaking the track record
10—The Simplex, which won the 60-mile event on the first day
11—Flying start of the contestants for the Remy Brassard
12—Harry Cobe in the Jackson, which finished second in the 50-mile event

		Class D, Free-for-all Australian Pursuit Race.		
33	National	Zengel	1	23 miles
18	Pope-Hartford	Disbrow	2	
20	Simplex	Lund	3	
10	National	Sheets	4	
		Class E, 600 cubic inches and under, Fifty Miles.		
18	Pope-Hartford	Disbrow	1	51:59.10
34	Jackson	Cobe	2	
5	Crow	Rost	3	
		One Mile Time Trial.		
1	Benz	Burman		48.72
		Division C, 161-230 cubic inches, Five Miles.		
19	E-M-F	Tower	1	5:41.16
29	Paige	Craig	2	
30	Paige	Shannahan	3	
24	Regal	Tate	4	

Will Handle American and Marion

Papers have been filed in Albany for the incorporation of the American-Marion Sales Company, a $100,000 corporation to handle the American and Marion cars in the Metropolitan district. The incorporators are: James I. Handley (formerly vice-president of the U. S. Motors), Chas. E. Riess, distributor of the Marion cars, and Geo. R. Morris, at present general manager for Chas. E. Riess & Co.

Missouri Licenses to Come Down

St. Louis, July 3—A general reduction of the price of automobile licenses is in prospect for St. Louis. A law passed by the last legislature regulating the State charge makes it incumbent on cities to charge no more than is authorized under the State law. For years the rate in St. Louis has been $10 for each car, regardless of the size, type or horsepower. Under the new law the average charge will be about $5. There have been 4,632 licenses issued in St. Louis so far this year.

The new law goes into effect Aug. 1. The city's lawmakers are expected to pass a new ordinance covering the situation before that date.

New Electric in the Field

Louisville, July 3—The Electric Vehicle Company, which will manufacture electric trucks, has opened its new plant at Preston and College streets. Later the concern will build electric pleasure cars. The new plant, which is the first in Kentucky to manufacture electric cars, covers 20,000 square feet of floor space. All of the machinery has been installed and the capacity of the plant at present will be about 100 cars each year. Those interested in the new company are Lee Miles, of the Miles Auto Company, E. M. Drummond and H. B. Hewitt, who has been connected with the Cooper-Hewitt Company.

A panel-delivery standard body, with other types optional, will be used on both the 600 and 1,000-pound vehicles. The silent chain drive has been adopted. A wheel base of eighty-six inches is used. Fully loaded the trucks are capable of traveling from 12 to 15 miles per hour.

Premier Caravan on Westward Way

Indianapolis, Ind., July 5—After two days of feasting and sight-seeing in Indianapolis the sturdy Ocean-to-Ocean Premier tourists again turned their faces westward this morning. The first 1,000 miles of the long journey, from Atlantic City to Indianapolis, were accomplished with no more wear or tear or mishaps than are generally encountered. The big party of Philadelphia and New York business men, with their families and friends filling eleven cars, were as enthusiastic as children just out of school and all were confident that the tour would be a success.

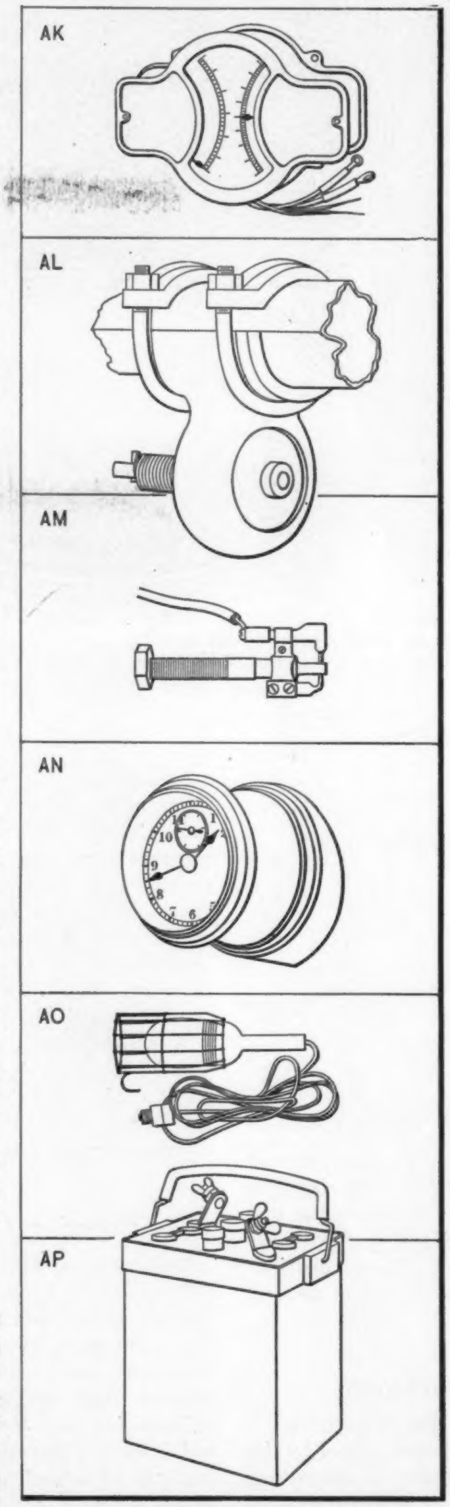
The Northern route across the Great American desert will be followed, Chicago being the next stop on the schedule after the departure from Indianapolis. From Chicago the route lies through Des Moines, Ia., Omaha, Denver, Cheyenne, Salt Lake City, Reno, San José, San Francisco, Santa Barbara and Los Angeles. The tourists are due to arrive at the latter place September 10.

Seen in the Show Window

KNOWING a situation is equivalent to being able to describe it, and controlling the powers of nature includes not only their utilization, but also the possibility of measuring their amounts and intensities. This being true and applied to that most popular energy, electricity, it is seen that the many ways in which it is utilized to-day have brought about the construction of almost as many sorts of instruments of measuring and controlling that force, the fundamental of these appliances being voltmeters and ammeters. Since automobiles, at the present time, use considerable quantities of electricity, for propelling cars, igniting a mixture and illuminating the machines at night, it was only natural that special types of instruments for measuring the energy used in the work of charging automobile batteries were constructed. One of the up-to-date results of these efforts is illustrated at (AK), this being the volt and ammeter of the Weston Electrical Instrument Company, whose factory is at Newark, N. J.

TO increase the driver's efficiency as well as his good disposition is a proposition which cannot but interest the gentleman automobile owner, and the little step in the forward direction which will bring him to the end desired is the acquisition of an electric lamp ignitor, an example of which, the Hart Instantaneous Gas Lamp Ignitor, is shown at (AM). By means of this device the driver, after opening the way for the acetylene to the headlights, ignites the gas without leaving his seat, by the simple expedient of pressing a button or turning a key, whereby a circuit is closed and a battery in conjunction with a sparking coil produces a spark above the acetylene burner, which is sufficient to instantly ignite the gas. This igniter is made by the Hart Gas Light Igniter Company, of Hartford, Conn.

THERE are occasions where the cut-out comes in handy, as in starting up a hill, and the silencing effect of the muffler will have to be sacrificed at such times for the utilization of what otherwise makes itself felt as back pressure. The S. B. R. Muffler Cut-out is illustrated at (AL), and being of simple construction, it is easily installed on a car in the minimum of time. The cut-out valve seen at the lower portion of the device, and which has a ground seat with spring holder, is operated from the dash by a pedal in the usual manner. This appliance is the product of the S. B. R. Specialty Company, of East Orange, N. J.



AK—Type of volt-ammeter for various uses in connection with automobiles
AL—Illustrating one of the latest types of muffler cut-outs
AM—Enables the driver to light his lamps without leaving the seat
AN—Keyless dash clock which will prove a convenience for automobilists
AO—The Morse special type of portable electric lamp for garages
AP—Outward appearance of the Geiszler storage battery

STORAGE batteries are used on automobiles for several purposes, and, judging from present tendencies, the number of their applications in this field seems to be still on the increase. Compactness and efficiency, together with a relatively high capacity, are the main features looked for in batteries, but there are also some points of chemical rather than physical nature, these being the degree of sulphation that the various types of accumulators are subject to. The Geiszler storage battery, an illustration of which is here afforded (AP), is claimed by its makers to be non-sulphating, and the manufacturers guarantee that the battery will not deteriorate while it stands idle. It is manufactured by the Geiszler Bros. Storage Battery Company, whose address is 1512 W. Fifty-seventh street, New York.

TOO many accessories crowded on the dash may be a nuisance, but just because this is so it will be necessary for the autoist to weigh out carefully the importance of all the various devices which may be placed there, before deciding to eliminate some of them therefrom. Every motorist will grant that having the right time before him is a very desirable state of affairs, because a clock on the dash will never be considered a nuisance if compared to the timepiece which is carried in one's pocket and is hard to get at when driving. The Perfect Auto Clock, which has a Seth Thomas movement contained in its makeup, is shown at (AN), a special feature of this clock being that it is not wound up by means of a key, but the bezel is turned around once a week. This strong little piece of machinery is made by the Phinney-Walker Keyless Clock Co., of 77 E. 130th street, New York.

ELECTRIC light must necessarily be used all over in garages, and it is found in the important regions of these establishments; but the employees are not very frequently equipped with portable lights permitting of looking over any parts of a car without using any other illumination but an electric bulb. A special type of garage lamp is made and sold by Frank W. Morse of 516 Atlantic avenue, Boston, Mass., the lamp being shown at (AO). It consists of a vapor-proof globe containing a 16-candlepower lamp, a waterproof socket in handle, silvered guard and reflector, together with 12 feet of slicked cord and a two-piece plug. A special feature of this lamp is its being perfectly proof against combustible vapors.